Current Programs for Estimating Radiological Dose and Chemical Exposure

Volume II

Section I • Programs for Estimating Exposure to Chemical Toxicants

Section II • Programs Relating to Radiological Doses and Chemical Exposures

prepared for

Centers for Disease Control and Prevention
Department of Health and Human Services

Center for Epidemiologic Research
Oak Ridge Associated Universities

March 31, 1997

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LIST OF ACRONYMS

ACGIH	-	American Conference of Governmental Industrial Hygienists
AEDE	-	Annual Effective Dose Equivalent
ASO	-	Analytical Services Organization
BDMS	-	Bioassay Data Management Systems
BOD	-	Biochemical Oxygen Demand
CAM	-	Continuous Air Monitor
CEDE	-	Committed Effective Dose Equivalent
CT	-	Calibration Test
CTS	-	Comprehensive Tracking System
DOE	-	Department of Energy
FOIA	-	Freedom of Information Act
FRF	-	Field Request Form
HSO	-	Health Services Organization
ICP-OES	-	Inductively Coupled Plasma - Optical Emission Spectrometry
IH	-	Industrial Hygienist or Industrial Hygiene
IHD	-	Industrial Hygiene Department
IHIM	-	Industrial Hygiene Information Management or Manager
IRE	-	Internal Reference Element
ITSD	-	Information Technology Services Division
LCR	-	Lowest Count Reported
LMES	-	Lockheed Martin Energy Systems, Inc.
LRL	-	Lowest Reporting Level
MDA	-	Minimum Detectable Activity or Amount
MMMF	-	Man-Made Mineral Fibers
MVD	-	Mercury Vapor Detector
NBS	-	National Bureau of Standards
NIOSH	-	National Institute for Occupational Safety and Health
NIST	-	National Institute of Standards and Technology
OHIS	-	Occupational Health Information System
ORNL	-	Oak Ridge National Laboratory
OSHA	-	Occupational Safety and Health Administration
PCM	-	Phase Contrast Microscopy or Microscope/Personnel Contamination Monitor
PEL	-	Permissible Exposure Limit
QC	-	Quality Control
RADCON	-	Radiological Control
RPS	-	Radiation Protection Standard
SAM	-	Sampling Area Monitor
SMS	-	Site Management Services
TEDE	-	Total Effective Dose Equivalent
TLD	-	Thermoluminescent Dosimeter

TMS	-	Training Management System
TWA	-	Time Weighted Average
ZPP	-	Zinc Protoporphyrin

BERYLLIUM AIR AND SMEAR MONITORING PROGRAMS

OVERVIEW

Purposes of Programs

The Industrial Hygiene Department (IHD) at the Y-12 Plant in Oak Ridge operates Beryllium (Be) Air and Smear Monitoring Programs for the purposes of evaluating and controlling air and surface contamination in areas where Be is presently or previously processed.

Brief Description of Monitoring Programs

Known amounts of air are drawn through cellulose or millipore papers to collect airborne Be, and surfaces are wiped with cellulose paper to collect deposited Be. These papers are then analyzed for Be making it possible to determine concentration in air in units of µg per m^3 or removable surface contamination in units of µg per 100 cm^2.

Exposure Potential

Development work and production machining of Be is done on a small scale at Y-12. In addition, a number of posted Be-regulated areas remain in the facility from previous, more extensive operations.

Purpose of Report

The purpose of this report is to describe in detail the various facets of the Be monitoring programs and their operation with special emphasis on the utilization of results. This report is part of a larger volume aimed at documenting all currently installed monitoring programs at Y-12 that may generate data useful for health and safety activities or studies.

PROGRAMS

Permanently Located Continuous Monitoring Air Samplers

Several hundred permanently located air sampling stations have been used to monitor airborne Be in the Y-12 Plant. These sampling stations monitor areas that are presently considered Be-regulated areas: a laboratory area, a development area, and production areas, and other areas where Be was previously handled. Since the Y-12 Plant was in stand-down during most of 1995 and early 1996, very little Be work was done. Currently, there are approximately 15 permanently installed Be samplers near the present Be operations areas that are run only during the weeks when Be operations are performed. During March 1996, 42 air samples were taken at these locations. The organizational Industrial Hygienist (IH) decides where and how many samples are to be collected by the IH field technicians. The following steps are to be taken in collecting these samples and are excerpted from a checklist provided to the technicians:

- Proceed to the filter paper holder which hangs from the ceiling and is part of the fixed air monitoring system that includes a vacuum pump.

- Wearing clean, impervious, disposable gloves, use tweezers to remove filter.

- Without allowing the filter to contact any other surface, fold it in half with the exposed side in and place it completely inside the window packet on an appropriately identified card.

- Remove disposable gloves and don a clean pair.

- Recalibrate the airflow to 19.5-20.5 liters/minute.

- Remove clean filter from the window packet of the sample identification card and place it in the filter head, then replace the holder.

- At the end of the sampling job, wet wipe equipment, materials, etc., as necessary and applicable. Dispose of any waste as beryllium contaminated waste.

- Deliver the collected air samples to Building 9995 for analysis.

- Have a completed chain of custody form signed by plant lab personnel upon receipt of samples.

- Prepare IH sample information forms prior to receipt of final results from the plant lab.

- Complete the IH sample information forms upon receipt of the final results from the plant lab.

- Notify IH Information Management Section to pick up the completed sampling results package.

Personal Air Sampling

The personal air sampling program monitors the breathing environments of individuals by using air samplers attached to the employees. A battery-powered portable pump mounted on the belt of an employee draws two liters of air per minute through a hose attached to a filter head located in the breathing zone of the employee. Ideally, the sampler is worn continually for eight hours while the employee performs usual work tasks. If necessary, samples of shorter duration are collected. Procedures similar to those prescribed above for continuous air monitoring samples are followed in collecting personal air samples.

Surface Contamination Monitoring

Two smear sampling programs are used at the Y-12 facility for monitoring surface contamination with Be. One program is routinely used to evaluate and assist in Be contamination control of all areas designated as regulated Be areas. A regulated Be area is defined as any area where the Be surface contamination consistently exceeds 5 μg Be/100 cm^2 smear. On a predetermined periodic schedule, surface smear samples are collected at designated locations. The designated locations are formally described as general areas. The precise locations within the general areas are selected by the IH technician at the time of sampling. Nonroutine smears also may be collected as needed.

The second surface contamination smear program provides for monitoring of equipment and material identified for transfer from a regulated Be area either to a nonregulated area within the plant, or to be transferred off site. Program requirements specify that any surface samples from equipment or materials to be transferred must show less than 5 μg Be/smear; otherwise, additional cleaning is required until the equipment or materials meet the maximum contamination level, or they remain in the regulated Be area. Smear samples are taken using the following procedures:

- Place a 100 cm^2 template over the area to be wiped, or visually estimate a 100 cm^2 area.
- Using clean unused disposable gloves, obtain a dry Whatman filter.
- With the Whatman filter, wipe a 100 cm^2 area one time only, using a wipe sampling pattern that completely covers the sampled area.
- Without allowing the filter to contact any other surface, fold the wipe in half with the exposed side inward and place the filter completely inside the window packet of an appropriately identified card.

Remaining steps for delivery, control, and processing of the smear samples are the same as those listed above for continuous monitoring air samples.

Sample Identification

Be samples are identified for submission to the analytical laboratory only to the extent necessary to relate the laboratory's results to the correct samples. Detailed information such as sample location and by whom the sample was collected resides on the IH information form. Personal air samples are further identified by employee and the employee's assigned department when the sample was collected. This form goes to the IH Information Management (IHIM) Section and is entered into the Occupational Health Information System. From this information system, various reports can be prepared on the sampling results.

SAMPLE ANALYSES

Laboratory Analysis

Once the Be samples are received at the analytical laboratory, they are analyzed by the Y-12 Analytical Services Organization (ASO) according to Procedure Y/P65-0019. This procedure specifies the apparatus, reagents, and materials to be used and presents this summary of the test method:

> Air, environmental, and smear samples collected on filter media made of cellulose (for example, Whatman 41) or of mixed esters of cellulose acetate and nitrate (for example, Millipore) are digested by using a mixture of sulfuric acid and hydrogen peroxide. A commercial laboratory-type microwave digestion apparatus is used to assist the dissolution. The sample solution is spiked with yttrium (Y) as an internal reference element.
>
> The simultaneous multielement determination is done on an Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES). The method measures emitted light by optical spectrometry. Samples are nebulized, and the resulting aerosol is transported to the plasma torch. Element-specific atomic line emission spectra are produced by a radio frequency Inductively Coupled Plasma (ICP). The spectra are dispersed by a grating spectrometer, and the intensities of the lines are monitored by photo multiplier tubes. Data collection and calculations are done by computer.

Quality Control (QC)

Laboratory QC is maintained by continual testing of external control samples at 1 µg, 10 µg, 25 µg, and 50 µg levels. The currently accepted percent relative standard deviations at these levels are ±4.4%, ±3.0%, ±3.2%, and ±4.0%, respectively. The bias for these levels are -0.02 µg ± 0.034 µg, 0.18 µg ± 0.24 µg, 0.54 µg ± 0.60 µg, and -1.14 µg ± 1.51 µg, respectively at the 95% confidence level.

These control program amounts of Be are added to filter paper using standard solutions and submitted to the Plant Lab as partially blind samples. They are distinguishable from regular samples by not having the dirt or dust associated with air samples and smears.

Each Be analysis series is begun by processing four standards prior to running any samples to assure that the equipment is correctly standardized. Each sample is continually subjected to preprogrammed computerized tests. If sample analysis results do not meet the specifications mandated for these checks, the IH technician is advised of these failures by flags in the computer printout. Four independent measurements are made on each sample. If the average of the first two measurements does not agree with the average of all four measurements within $\pm$5%, the results are flagged so the cause(s) can be investigated and any necessary adjustments can be made and documented. In addition, if the amount of the internal reference element, which is added to each sample during analysis, does not fall within a specified range, similar action is taken.

The analytical laboratory also processes internal controls. These controls are so identified to the computer which prints out a warning if the associated results do not meet specified criteria.

Minimum Detectable Amount (MDA)

The Lowest Reporting Level (LRL) by the ASO is currently stated to be 0.05 µg per filter. As a matter of policy, the ASO designates the LRL by first determining the MDA from a statistical analysis of blank sample results then setting an administratively determined higher amount as the LRL.

USE OF THE DATA GENERATED

Limits and Action Points

Data from the Be monitoring programs are compared to established limits and action levels. The currently established limit at Y-12 for Be in air is 2 µg/m^3 , as specified by the American Conference of Governmental Industrial Hygienists and adopted by the Occupational Safety and Health Administration (OSHA) as the Threshold Limit Value for Be. The established limit for surface contamination is 25 µg/smear, a level that has been traditionally and successfully used in the Y-12 Plant.   The plant uses levels of one-half the limit values (1 µg/m^3 for air and 12 µg/smear) as action levels. The selection of one-half these values for the action points was a decision aimed at ensuring worker protection by restricting maximum levels at or below the limits.

If the action level for air results is exceeded, an investigation is conducted. Depending on the determination(s) of the investigation, respiratory protection may be continued or instigated, and engineering or procedural changes may be made as appropriate. If the smear action level is exceeded, respiratory protection is required for personnel cleaning the area.

Records and Reports

The results of personal air samples are reported to the individual sampled through their supervisor. The report sheet is signed by both the sampled individual and the supervisor to document that the results have been shown to the appropriate persons. The results are also made available to the plant medical director or his designee upon request. It is understood that requests for such information are usually made prior to a periodic physical examination of the employee. In addition, results of continuous air samplers and smear results are electronically mailed to the appropriate supervisors.

As indicated above, the results of this program are currently being maintained in a computerized format. These data are retrievable and a computer report could be run for any selected time period; however, such reports are seldom prepared. No reporting other than that just discussed is routinely done. It was stated by the Head of the Information Management Section of the IHD that IH personnel currently were not looking at overall statistics associated with this or other IH programs.

RESULTS AND PROGRAM COSTS

Brief Summary of Recent Results

The following information on 1994 to 1996 Be results (Tables 1 and 2) was obtained from the Supervisor of the Information Management System. It is again noted that the Y-12 Plant was in stand-down mode for most of 1995, and there was little, if any, production work.

Table 1. Beryllium Personal Air Results

		Numbers			Results (µg/m^3)		
Period	**Type**	**Total**	**<LRL**	**>Limit**	**High**	**Average[1]**	**Limit**
1994	8 hrs TWA	162	111	4	11.3	1.1	2.0[2]
1994	Excursion	2	2	0	-	-	25.0
1995	8 hrs TWA	13	13	0	-	-	2.0[2]
1995	Excursion	0	-	-	-	-	25.0
1996 to 6/3	8 hrs TWA	31	31	0	-	-	2.0[2]
1996 to 6/3	Excursion	0	-	-	-	-	25.0

[1] Only sample results > LRL are averaged.
[2] OSHA Limit.

Table 2. Beryllium Continuous Air and Smear Results

		Numbers			Results (µg/m^3)		
Period	**Type**	**Total**	**<LRL**	**>Limit**	**High[1]**	**Average[2]**	**Limit**
1994	Air	607	540	2	20.19	0.14	7.5[3]
1994	Smear	0	-	-	-	-	25.0
1995	Air	214	192	0	2.12	0.06	7.5[3]
1995	Smear	240	193	1	33.4	0.46	25.0
1996 to 6/3	Air	160	114	9	105.0	2.07	7.5[3]
1996 to 6/3	Smear	490	378	2	35.0	0.52	25.0

[1]High is based on total amount of Be on the sample paper.
[2]Average is based on total amount of Be on the paper. Samples less than the LRL were assumed to be 0.025 µg.
[3]Air limit is based on half the amount of Be that would be on the filter, assuming all the Be was collected during one 30-minute excursion (0.6 m^3 at 0.02 m^3/min) with the concentration at the Y-12 excursion limit of 25 µg/m^3.

<u>Relative Program Cost</u>

It is estimated that the relative cost of the Be monitoring programs is approximately 30 percent of the total cost of the seven IH programs reported in this volume. Although little Be has been processed at the Y-12 Plant in recent years, there is a great interest in Be brought about mainly by the finding of several cases of chronic beryllium disease among the Y-12 work force. This enhanced interest, including a large effort expended to computerize the large amount of previously generated Be data (described in Retrospective Dose and Exposure Reporting Programs in this volume), is responsible for the relatively high cost of the Be monitoring programs.

PROGRAM EFFECTIVENESS

Evaluation

Although Be processing is not extensive at this time, it appears that the IHD programs are effective in controlling Be exposures as evidenced by average levels and maximum levels from personal samples being below the plant action levels. Only a small percentage of the continuous air sampling results exceeded the very restrictive limit established for this monitoring program.

Conclusions

1. There appears to be no following of trends and only limited reporting.
2. The present policy to monitor all Be workers with personal air samples is reasonable since the current number of workers involved is relatively small.

Recommendation

A periodic overall reporting should be made to Y-12 management and supervisors as to current Be air and smear sampling results and how they compare with previous results.

LEAD AIR AND BLOOD MONITORING PROGRAMS

OVERVIEW

Purpose of Programs

Operated by Lockheed Martin Energy Systems, Inc., for the U.S. Department of Energy, the Industrial Hygiene Department (IHD) of the Y-12 Plant maintains lead monitoring programs to help assure that no Y-12 employee is unduly exposed to lead and that the plant complies with applicable regulations.

Brief Description of Programs

The lead monitoring programs consists almost entirely of personal monitoring of two types, (1) personal air sampling, and (2) blood sampling and analysis for lead level and for Zinc Protoporphyrin (ZPP) which is increased as a result of lead exposure.

Exposure Potential

The exposure potential for lead at the Y-12 Plant is relatively low and is mainly associated with lead in paint. Maintenance workers that repaint surfaces, repair or remove painted surfaces may be subjected to this exposure potential. A limited number of other workers involved with the handling or disposal of removed paint also may have potential for exposure to lead. There is a lesser exposure potential associated with lead bricks or lead-covered walls which are used to shield from ionizing radiation. All walls consisting of or covered with lead are labeled to warn employees that drilling, sanding, or performing other operations on the walls could result in the generation of airborne lead which must be controlled. Warning labels include instructions to notify the IHD for safety recommendations prior to performing these or similar tasks.

Purpose of Report

This report will describe in detail the Y-12 Plant's lead monitoring programs with emphasis on utilization of the generated results. This report is part of a larger volume aimed at documenting currently installed monitoring programs at Y-12 that may generate data useful for health and safety activities or studies.

PROGRAMS

Selection of Participants

Lead workers are defined as persons who have special training and meet the other required qualifications for working with lead or lead-bearing materials. In addition, these workers must work as much as one day a year in an environment having an air lead concentration that equals or exceeds the weighted eight-hour Threshold Limit Value or as much as 30 days a year in a controlled lead area. It is the responsibility of the Lead Program Coordinator to maintain and annually update a current listing of approved lead workers. Personnel on this list are scheduled to participate in the blood lead analysis program at least once a year.

Lead workers also may be scheduled to wear a personal air sampler; however, not all lead workers are monitored by personal air samplers. In practice, personal air sampling is not conducted on workers performing short and infrequent operations. Some of the personnel that perform full-day operations for several consecutive days will be sampled for personal air environment. An example of such an operation would be paint scraping in large areas. Even in these situations, the workers sampled will be those judged to have the longest and highest exposure potential.

Scheduling Participation

Air Sampling. Individuals are scheduled for participation in the personal air lead sampling program through their supervisor by the Lead Program Coordinator, Organizational IH, or a designee as necessary to meet the objective of the program.

Blood Sampling. All lead workers are assigned to the blood lead sampling program and participate at least annually. The employees' supervisors are responsible for making appointments and sending employees to Health Services Organization (HSO) with a signed request from the Organizational IH or the area IH Technician. In addition, any employee who is inadvertently occupationally exposed to lead above plant action point levels will be scheduled for such blood sampling.

Participation

Air Sampling. Each person selected for personal air monitoring is provided with a portable air sampling pump worn at the waist with a sample holder head attached to the pump via flexible tubing and positioned in the breathing zone of the employee. The associated rotameter is set for a sampling rate of two liters per minute, and air environments for all tasks performed by the monitored person within an eight-hour shift are sampled. The sample is removed from its holder at the end of the operation and sent to the Analytical Services Organization (ASO) for analysis. The results of such samples compiled for a shift are considered to be eight-hour Time Weighted Averages (TWA).

Blood Sampling. A person assigned to the blood lead program reports to the HSO building at a prescheduled time where a blood sample is drawn by an HSO employee and sent to the contracting laboratory for analysis. Results of this analysis are for point samples and are used to compare against the plant action and compliance levels.

SAMPLE ANALYSIS

Personal Air Samples

Sample Submission

Air samples are identified for submission to the ASO only to the extent necessary to assure that the results get returned to the IHD technician responsible for them. The technician is responsible for delivering air samples to the ASO and requesting the appropriate analyses for them.

Laboratory Analysis

The ASO analyzes the air lead samples according to Procedure Y/P65-0017 Rev. A by Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES). This method uses such a spectrometer and is described in the procedure as follows:

> Air and smear samples collected on filter media are solutioned using nitric acid (HNO_3) and heat. Hydrofluoric acid (HF) is added for some elements. An Internal Reference Element (IRE) is added to the solution. Simultaneous multi-element determination is performed on an ICP-OES. The method measures emitted light by optical spectrometry. Samples are nebulized, and the resulting aerosol is transported to the plasma torch. Element specific line emission spectra are produced by a grating spectrometer and the line intensities are monitored by photomultiplier tubes. Data collection and calculations are done by computer. This procedure may be used for air and smear samples collected on filter paper.

Quality Control
A determination is made of the percent recovery of the IRE. If percent recovery is less than 80 percent or more than 120 percent of the amount added all likely causes are investigated and necessary adjustments and comments are made and documented. If the blank value exceeds the Lowest Reporting Level (LRL) and can be traced to reagents, necessary corrections are made and documented. If the determination on the check sources is greater than three standard deviations from the mean that has been determined for the source, there is a serious calibration problem which may require that part or the entire run be rerun after causes of the problem have been found and corrected.

Bias and Precision
The ASO laboratory documentation, dated November 2, 1994, states that 11 filters were spiked with a known amount of lead and analyzed by this method. Analyses of the samples indicated that there was no bias in the method and that the percent standard deviation was ± 0.609.

Minimum Detectable Amount (MDA)
The ASO has a policy of setting an LRL that is greater than the MDA as it is determined using the standard deviation associated with the blank. The ASO lists 0.6 µg per filter as their LRL for lead.

Result Handling
When the ASO finishes the analyses, information on the amounts of lead found on these samples is forwarded to the IHD technician who then calculates the concentration of lead per unit volume of air for the samples and forwards that information along with information on who took the sample, sample time, sample location, and any other pertinent facts. This information is entered into the Occupational Health Information System (OHIS) by the Information Management Group.

Blood Samples

Blood samples are sent to a contracting laboratory, approved by the Occupational Safety and Health Administration (OSHA), for analysis. These samples are analyzed for lead and for ZPP. The present contracting laboratory is located in Nashville, Tennessee, and is operated by SmithKline Beecham, Inc. Results from these analyses are returned to the IHD Lead Program Coordinator for perusal, action, and reporting.

EXTENT AND COST OF THE PROGRAMS

Size of the Programs

There are approximately 130 individuals presently classified as lead workers and subject to have lead and ZPP samples run on them at least annually. During 1995 blood lead results were analyzed on 100 samples, ZPP on 86 samples, and personal air lead results on 17 samples. It has been estimated that the effort going into the lead programs is of the order of 15 percent of the total effort going into the seven IHD programs discussed in this report.

Medical Surveillance

There is a Y-12 Plant Medical Surveillance Programs that requires inclusion of lead workers as defined in the above Program topic. These programs are updated every six months for changes in employee assignments with the assistance of plant managers and supervisors. Changes also may be made at other than regularly scheduled updating times at the discretion of the supervisor. Lead workers must be fitted with respirators and must undergo and pass designated medical checks before they are given a medical clearance to work with lead.

Summary of Recent Results

The table below shows the results of personal air samples since 1993.

Table 1. Personal Air Lead Sample Results

		Number			Concentration (mg/m^3)		
Period	**Type**	**Total**	**<LRL**	**>Limit**	**Maximum**	**Average***	**Limit**
1994	8-hr TWA	47	30	0	0.034	0.0062	0.05
1995	8-hr TWA	17	15	0	0.0006	0.0006	0.05
1996 until June 3	8-hr TWA	2	2	0	--	--	0.05

*This is the average of the samples that exceeded the LRL.

The results of the blood analyses are tabulated below:

Table 2. Lead and Zinc Protoporphyrin in Blood

					Concentration µg/10 dL		
Period	**Type**	**Total**	**<LRL**	**>Limit**	**Maximum**	**Average***	**Limit**
1994	Lead	77	16	0	17.0	3.8	50.0
	ZPP	76	2	1	92.0	20.4	70.0
1995	Lead	100	17	0	15.0	4.3	50.0
	ZPP	86	0	0	55.0	20.6	70.0
1996 until June 3	Lead	72	24	0	16.0	4.2	50.0
	ZPP	72	0	0	41.0	20.8	70.0
Totals		483	59	1			

*This is the average of the samples that exceed the LRL. For lead the LRL is 3 µg/dL. Since zinc protoporphyrin is normally present in blood, the level is rarely below the MDA.

USE OF RESULTS

Limits and Action Points

Results of blood and air samples analyzed for lead are compared to the action point and limit so that appropriate action may be taken if either is exceeded. The action point and limit for lead in blood are 40 mg/10 dL and 50 mg/10 dL, respectively. If an employee demonstrates a blood lead level of 40 mg/10 dL, action is taken to minimize exposure. If the limit of 50 mg/10 dL is exceeded, the employee is medically restricted from working in a lead area. Both the limit and action points are specified by OSHA.

The Y-12 Plant action point and limit for concentration of lead in air are 30 µg/M^3 and 50 µg/M^3. These points are based on the Permissible Exposure Limit (PEL) established by OSHA, the action point being set at 0.6 of the PEL. If the limit is exceeded for an eight-hour TWA, the individual is scheduled for a blood analysis.

Recording Results

The results from the blood lead and ZPP analyses and the personal air analyses are reviewed by the IHD Lead Program Coordinator and are entered in the OHIS for record storage. Results are retrievable from this system as needed for reporting.

Reporting Results

The results of personnel air samples and blood lead and ZPP results are reported to the individual through the supervisor on the form shown below.

Business Sensitive

Lead Biological Monitoring

Internal Correspondence

Date Report Received: 1/12/96

Date of Sample: 1/5/96
Sample I. D. #: 5884622

Supervisor:

Employee Name:
Badge #:
SSN:
Organization: Enriched Uranium

Biological Monitoring Results				
Agent	Result	Action Level	Medical Removal	Units
Lead	3	>40	>50	ug/10 dl
ZPP	17	>70	-	ug/10 dl

ND - Nondetectable (Less than the limit of quantification)

Further action required: None

This form must be co-signed and dated by the supervisor and employee and returned within **Fifteen Working Days** after receipt of this letter to:

Lead Program Coordinator
Building 9106, MS-8023

Should you have questions, please contact me directly.

______________________ ___ / ___ /___ Phone 576-0303
V.W. Phillips

I was informed on: ___ / ___ /___

____
Employee

Employee was informed on: ___ / ___ /___

____
Supervisor

Business Sensitive

Figure 1. Lead Blood Sampling Report

Both the supervisor and employee are required to sign the form indicating the employee was informed of the results of the analysis.

No other reports are routinely made on these results. Since the results are on the computerized OHIS they can be inspected, and numbers and averages can be printed as needed. Additional reports could be easily generated if a need for such reports was perceived to exist.

PROGRAM EFFECTIVENESS

Evaluation

The lead exposure monitoring programs presently implemented at Y-12 appear to be well run and are effective in controlling exposures as indicated in the Summary of Recent Results topic above. The extremely low results in 1995-96 are in part a result of the plant stand-down in effect those years.

Observation

No reporting is being done on results of lead programs other than the reports of blood and personal air samples to the employee involved and the appropriate supervisor.

Conclusion

Since the personal analytical results are computerized, use of results to periodically report on general experience and how it compares to previous experience would be easily accomplished and would keep the Y-12 Plant managers cognizant of the success of the programs. Periodic summary collective reports on this and other IHD programs also might be useful for long-range planning.

MERCURY AIR AND URINE MONITORING PROGRAMS

OVERVIEW

Purposes of Programs

The Industrial Hygiene Department (IHD) at the Oak Ridge Y-12 Plant maintains air and urine sampling programs for mercury in order to (1) evaluate the continuing effectiveness of controls to reduce mercury exposure, (2) help ensure worker health and safety, and, (3) show compliance with regulation. The plant is operated for the U.S. Department of Energy by Lockheed Martin Energy Systems, Inc.

Brief Description of Programs

The IHD advises both Plant Engineering and Maintenance Division personnel and construction subcontractor personnel as to what precautions are to be taken when they undertake projects involving mercury contamination. The IHD also maintains surveillance programs that include routine urine sampling of mercury workers. Personal and area air sampling programs are maintained for mercury-regulated areas. Known amounts of air are pulled through a material that absorbs the mercury which is analyzed for mercury content and thereby used to quantify concentration. Mercury Vapor Detectors (MVD) electronically quantify mercury concentrations in a few seconds to quickly evaluate situations involving airborne mercury.

Exposure Potential

Previously, the Y-12 Plant operated lithium isotope separation facilities which involved tremendous quantities of mercury. Although these facilities are no longer used for this process, enough residual mercury was left in nine Y-12 buildings that they are classified as known to contain mercury. Consequently, any construction or renovation project associated with these buildings is evaluated to determine whether a mercury-regulated area needs to be established. Presently, one of these buildings (9201-4) is undergoing decontamination and decommissioning which classifies it as a mercury-regulated area requiring mercury surveillance programs. Periodically, work done in the basement of Building 9201-2 also requires such an area classification and surveillance. In addition, if any visible mercury is sighted in any of these buildings, the mercury will be picked up and the situation evaluated.

Purpose of Report

The purpose of this report is to describe in detail the Y-12 mercury sampling programs with special emphasis on the utilization of the information gathered. This report is part of a larger volume aimed at documenting current IHD exposure monitoring activities that may generate data useful for health and safety activities or studies.

PROGRAMS

Personal Sampling

All personnel, who are designated as mercury workers by their supervisor with the assistance and concurrence of the IHD, are monitored on a routine basis.

Scheduled Participation

Employees who are designated mercury workers are scheduled to participate in the mercury urinalysis program on the first Monday of each month by furnishing a spot urine voiding upon reporting to work. These samples are analyzed for both mercury and creatinine content.

Sample Collection

Spot samples are collected from workers on Monday before going to work. The samples are collected in mercury-free glass bottles containing 1 g of potassium permanganate which will preserve the sample at room temperature for up to two weeks.

Some of the mercury workers are also scheduled to have personal air samples as well. This sampling is scheduled by an IHD technician assigned to the Mercury Regulated Zone. Based on his and her knowledge of operations, the technician arranges with the sampled employee to wear a personal air sampler while performing typical- or high-exposure potential operations for all hours worked during a shift. A portable air sample pump attached to the worker’s belt draws air at the rate of two liters per minute through a flexible hose connected to a solid absorbent tube which is placed in the breathing zone of the employee. The results of the analysis of the absorbent for mercury content along with the known volume of air sampled allows the concentration of mercury in air to be calculated. The concentrations can be used to determine the Time Weighted Average (TWA) for samples during a shift by the following formula.

$$TWA = \frac{(C_1 x T_1) + (C_2 x T_2) + (C_n x T_n)}{480\ \text{min}}$$

where

C = the concentration in mg/m^3, and
T = sample time in minutes.

Other Sampling

In addition to the personal sampling described above, air samples are taken in mercury contaminated areas with absorbent tubes to furnish information on specific jobs or locations. These samples are taken much like personal air samples but are not associated with any particular individual. The sampling protocol is similar to that for personal samples except for the sampling rate which is 15 liters/m.

Use is also made of portable MVDs that determine the ambient concentration of mercury vapor by taking 10-second air samples and displaying results in mg/m^3 on the meter readout until the subsequent sample is taken. A schematic of this instrument (6" wide, 13" long, and 4" high) is shown in Figure 1.

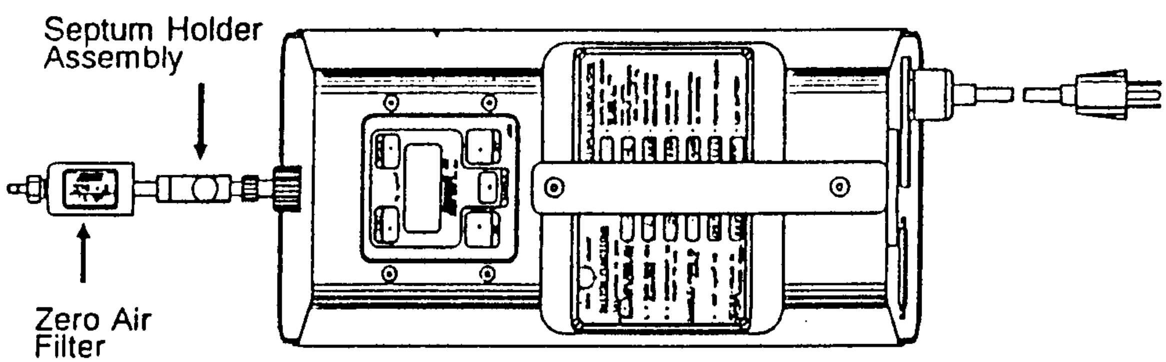

Figure 1. Mercury Vapor Detector

The IHD can use MVDs to quickly ascertain if there is enough mercury vapor in the air that further action is necessary in any particular situation. Waste Processing Decommissioning and Decontaminaton employees are using MVDs to spot check air concentration at approximately 60 locations on a twice-a-day basis at the 9201-4 decontamination and decommissioning operations. Copies of the results of these surveys are furnished to the IHD Mercury Program Coordinator.

LABORATORY ANALYSIS

Submission of Samples

Air samples taken with absorbent tubes are submitted to the laboratory by the sampling technician. The Analytical Services Organization (ASO) representative signs for the samples to maintain a chain of custody record. The urine samples are sent or taken to the ASO by the IHD Mercury Program Coordinator.

Laboratory Analysis of Air Samples

Mercury samples are analyzed by ASO personnel using National Institute for Occupational Safety and Health (NIOSH) Method 6009 slightly modified by the ASO for use in the Y-12 Plant. This procedure lists recommended reagents and equipment. Among the equipment listed is an atomic absorption spectrophotometer with a cold vapor generating system. The following brief summary of the method was garnered from this procedure:

> The sample is prepared for analysis by dissolving the Hydro sorbet by adding concentrated HNO_3 followed by concentrated HCl and diluting with dionized water. A portion of the sample is placed in a Biochemical Oxygen Demand (BOD) bottle containing additional deionized water. The absorption spectrometer is zeroed, then adjusted using a standard mercury solution. After those adjustments the mercury from the standard is vented and the next BOD bottle is swirled with 5 ml of 10% stannous chloride solution added to it. The BOD bottle is attached to a bubbler which is vented through the detector in the atomic absorption spectrometer until the spectrometer reaches maximum absorbance. The amount of mercury in the sample aliquot (W,µg) is determined from the calibration graph of the attached strip chart recorder.

Calculation of Results

The concentration C of mercury in the air volume sample (W/m^3) can be calculated by the following formula:

$$C = \frac{(W \times \frac{VS}{VA}) - B}{V}$$

where

W = weight of Hg in the dissolved sorbet,
VS = original sample volume (normally 50 ml),
VA = aliquot volume of dissolved sorbet (normally 20mL),
B   = average weight present in the medium blank, and
V   = volume of air sample in M^3 .

The quality assurance and controls, bias, and minimum detectable amounts for this analysis are similar to the ones presented below for the urine analysis.

<u>Laboratory Analysis of Urine Samples</u>

Analytical Procedure

Urine samples are transferred to the ASO for analysis by the atomic absorption method according to Procedure No. Y/P65-7626 Rev. 0. This procedure conforms to the NIOSH Manual of Analytical Methods, Methods P & CAM 165 and 167. This procedure lists the apparatus, reagents, and materials used and gives this summary of the test method:

> Whole blood and urine samples are digested with nitric acid, sulfuric acid, potassium permanganate, and lastly with potassium persulfate at 95˚ C for 2 hrs. After the reduction of excess permanganate, elemental mercury is aerated from solution by reduction with a stannous chloride solution. Sample mercury concentrations are determined by using a flameless Cold Vapor Atomic Absorption technique, which is based on the absorption of radiation at 253.7 nm by mercury vapor. Using a closed system, the mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer shown in Figure 2. The mercury concentration in the sample will produce an absorbance or peak height that is a function of this concentration.

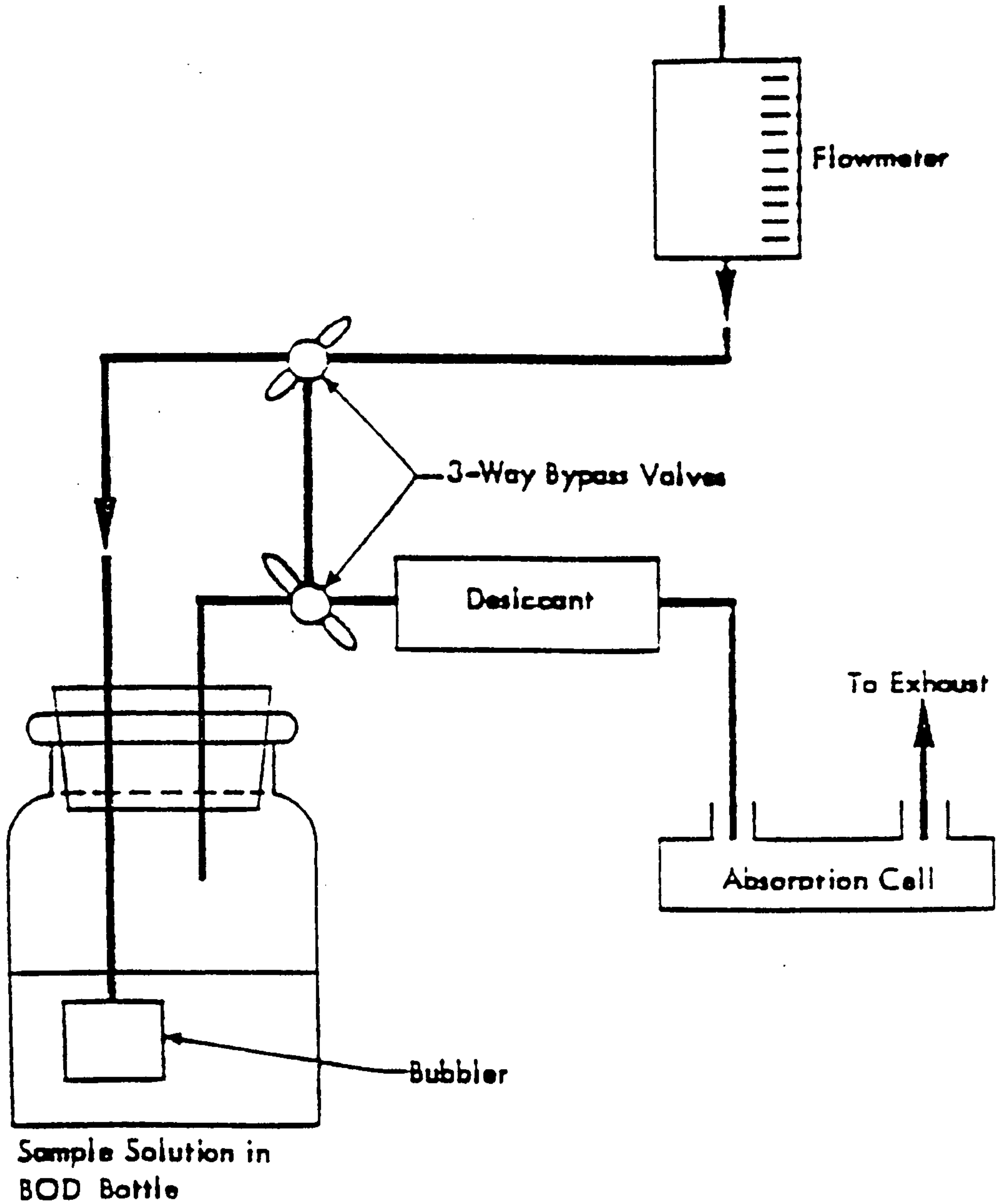

Figure 2. Atomic Absorption Spectrophotometer

Calculation of Results

The following equation is used to calculate the mercury concentration in urine:

$$Hg(\mu g/L) = \frac{A}{V}$$

where

A is the meter reading from the absorption cell spectrometer instrument in µg, and

V is the volume of the urine sample in L.

Quality Assurance and Control

To assure quality analyses the following checks are made:

- Blanks are processed prior to and during each sample analytical run.
- Duplicate analyses are performed on 10 percent of the samples processed.
- A spiked test sample is also analyzed with each 10 percent of the samples.
- Calibration check samples at four different levels are prepared using a different standard solution than that used for the initial calibration and these are processed with each batch of an analytical run.
- At least one quality control sample is analyzed with each analytical run. These are prepared using the National Bureau of Standards (NBS) 2672a Standard or some other standard that comes from a different source from that used for the calibration or calibration check samples.

If the results of any check do not fall within the prescribed limits, the analyst notifies the supervisor who decides what steps should be taken and whether the sample(s) must be rerun.

Precision and Bias

The results of the analyses of the Calibration Test (CT) and NBS traceable standards are collected and used to evaluate the precision and bias associated with the analytical method. The table below was excerpted from this procedure to illustrate the level of bias and precision associated with this laboratory method as it is used by the Y-12 ASO.

Table 1. Bias and Precision of Calibration Check and Control Samples

Type	No. of Analyses	Expected Value	Mean Value	% Bias	% Standard Deviation
CT	>1,140	0.100	0.103	+3.0	±8.8
CT	>960	0.300	0.316	+5.3	±5.4
CT	>690	0.500	0.512	+2.4	±3.5
CT	>690	1.00	1.02	+2.0	±4.4
NBS	>210	0.105 ± 0.008	0.107	+1.9	±2.5
CT = Calibration Test NBS = National Bureau of Standards					

Minimum Detectable Amount (MDA)

The ASO has information necessary to calculate the MDA by traditional methods, however, as a matter of policy they report a slightly higher level as their Lowest Reporting Level (LRL). The LRL for mercury in urine is 0.1μg in the sample.

USE OF RESULTS

Limits and Action Points

The results are compared to the limits and action points tabulated below so the appropriate follow-up action can be taken if the levels are exceeded.

Table 2. Mercury Program - Limits and Action Points

	Limit	Action Point
Mercury in air	.025mg/m^3	none
Mercury in urine	0.1mg/L	0.05 mg/L
Mercury/Creatinine	35μg/g	none

The air limit recognized by Y-12 ASO comes from the American Conference of Governmental Industrial Hygienists (ACGIH). This limit is also used as a Permissible Exposure Limit by NIOSH. The mercury urine and mercury/creatinine measurement limits are based on the Biological Exposure Indices published by the ACGIH. Any urine or air sample that exceeds the limit is investigated and appropriate corrective action for reducing the potential exposure is recommended as determined by the organizational IH. However, as shown below in Tables 3 and 4, in the Summary of Recent Results topic, no urine samples and only two (<4 %) of the air samples have exceeded the limit in the January 1, 1994, to June 6, 1996, period.

Reporting of Results

Results Involving Personnel

The results of urine samples and personal air samples are sent to the IHD Records Center and entered in the Occupational Health Information System (OHIS). From this system records can be retrieved at any time for any period since 1986. These results are also sent to the employee involved in the sampling through the immediate supervisor. Both the employee and the supervisor sign the report sheet indicating they have seen the results.

Area Sampling Results

Area samples showing higher levels than usual or expected are called to the attention of the supervisor of the Mercury Control Zone by the IHD Mercury Program Coordinator who maintains a file on such results. These results are also forwarded to the IH Records Center for entry into the OHIS.

Sixty air samples are taken twice each day by decommissioning and decontamination personnel in the 9204-2 Mercury Control Zone using the MVD, and the results of these spot samples are reported to the Waste Processing Decommissioning and Decontamination Supervisor and the IHD Mercury Program Coordinator. These sample results, however, are not entered into the OHIS. No written periodic reports are generated from the mercury results, which chronicles trends, and exposure problems or lack thereof.

COST AND RESULTS OF PROGRAMS

Size and Cost of Programs

The mercury monitoring programs include only one area on a routine basis with fewer than 20 people actively involved. However, because of the cost of the mercury urinalyses, the cost of these programs is estimated to be approximately five percent of that for the seven IHD programs reported here.

Summary of Recent Results

Tables 3 and 4 show a summary of personal sampling results since 1994.

Table 3. Mercury Urinalyses Results

		Number			Concentration (mg/L)		
Period	**Type**	**Total**	**<LRL**	**>Limit**	**Maximum**	**Average***	**Limit**
1994	Hg/urine	424	300	0.00	0.03	0.014	0.1
1995	Hg/urine	160	135	0	0.09	0.023	0.1
1996	Hg/urine	87	34	0	0.03	0.009	0.1
					Concentration (μg/g)		
1994	Hg/Creatinine	212	189	1	60.0	10.6	35
1995	Hg/Creatinine	159	145	2	60.0	20.1	35
1996	Hg/Creatinine	87	59	0	19.0	8.2	35
*Only samples ≥ LRL are used to compute the average.							

Table 4. Mercury - Personal Air Monitoring Results

		Number			Concentration (mg/m^3)		
Period	**Type**	**Total**	**<LRL**	**>Limit**	**Maximum**	**Average***	**Limit**
1994	8-hour TWA	49	16	2	0.189	0.018	0.05
1995	8-hour TWA	9	1	0	0.020	0.006	0.025
1996	8-hour TWA	4	0	0	0.005	0.004	0.025
*Only samples ≥ LRL are used to compute the average.							

Evaluation

The mercury monitoring programs are appropriately conceived and conscientiously implemented. At this time it appears to be effective in controlling exposures as judged by recent results.

Observations

1. More than half the mercury urine samples are less than the established LRL, and the average of the remaining samples is in the range of 15 percent of the established limit.

2. These favorable results are obtained in spite of the fact that decontamination and decommissioning activities, a relatively high potential exposure operation, are performed in an area where tremendous quantities of mercury were used.

Conclusion

The IHD could present its successes in these programs more effectively if periodic status summary and trend reports were issued.

ASBESTOS AIR MONITORING PROGRAMS

OVERVIEW

Purpose of Programs

Managed by Lockheed Martin Energy Systems, Inc. (LMES) for the U.S. Department of Energy, the Industrial Hygiene Department (IHD) at the Y-12 Plant in Oak Ridge, Tennessee, operates air sampling programs to help assure the plant meets regulatory requirements aimed at minimizing the exposure of plant personnel to asbestos.

Brief Description of Programs

The air sampling programs at the Y-12 Plant consist of several types of sampling. Personal samples are taken within the breathing zones of selected, potentially exposed employees working in asbestos-controlled areas. In addition, IH personnel take area samples within and just outside the designated asbestos control area to test and confirm that the area is as large as it should be. Upon completion of each job, large volume clearance samples are taken unless a variance is granted by the IHD. If these samples show an appropriately low asbestos level, the area is cleared for personnel to enter without special precautions. All asbestos air samples are analyzed by counting the number of asbestos fibers over a standardized filter area under a Phase Contrast Microscope (PCM). The fiber count is then related to the number of fibers per cubic centimeter (fibers/cm^3) of air.

Exposure Potential

Many facilities in the Y-12 Plant were built with asbestos-containing materials. Consequently, any renovations made in these facilities may generate airborne asbestos. Non-LMES construction contractors are generally involved with major projects resulting in the potential generation of airborne asbestos. These contractors are responsible for ensuring asbestos levels are maintained well within the limits established by the Occupational Safety and Health Administration (OSHA). However, the Y-12 IHD is obligated to oversee such operations to ensure no Y-12 employee is unduly exposed to asbestos. Also, the IHD has a responsibility to ensure that operations are performed according to regulations so the contractors' employees do not get overexposed and that air samples are taken to demonstrate that such is the case.

In addition to major projects there are a number of smaller projects, particularly those involving the displacement of insulation, where there is potential for asbestos exposure to plant personnel. The IHD also has responsibility of monitoring plant personnel performing such operations and helping assure any asbestos exposure is kept As Low As Reasonably Achievable.

Purpose of Report

The purpose of this report is to furnish details on how these programs are operated with special emphasis on utilization of results. This report is part of a larger volume aimed at documenting all currently installed monitoring programs at Y-12 that may generate data useful for health and safety activities or studies.

PROGRAMS

General

The Y-12 Plant maintains extensive control programs aimed at ensuring that any work that may result in exposure of plant personnel to asbestos is done according to appropriate procedures established by OSHA and the Environmental Protection Agency. Documentation is generated to demonstrate this compliance. The Y-12 Plant Site Management Services (SMS) has direct responsibility for these programs. These programs are supervised by the Asbestos Program Manager who works through the Facility Authority with the help of the Asbestos Management Program Committee. The IHD provides technical assistance to the SMS in this endeavor and is responsible for the monitoring of bulk materials to assess asbestos content. In addition, the IHD is responsible for collecting personal, work environment, and clearance air samples and reporting the results. The remainder of this report will address the IHD's asbestos monitoring programs.

Air Sampling-Personal

The IHD provides exposure monitoring for asbestos abatement jobs. Until recently, these jobs were selected for monitoring on a random basis. Personal breathing zone samples are collected to assess employee exposure to asbestos on each job. A record is kept of other workers for whom no personal sampling is done who participate in each job. The following field sampling steps are excerpted from an instruction sheet titled *Y-12 IH Asbestos Personal Sampling*.

- Collect equipment, materials, forms, and sample cassettes required for job.
- Calibrate personal sampling pump(s) to two liters/minute, ± 5%.
- Enter calibration results into logbook.
- Label required number of asbestos sampling cassettes with identification number(s). Include field blanks.
- Proceed to asbestos abatement area and prepare for sampling.
- Don and doff protective equipment as necessary to enter and exit the asbestos regulated area.
- Hang sampling pump on plastic belt (or appropriate alternative) on employee to be sampled. Hang sample cassette, tubing, and holder in the employee’s breathing zone with cassette in the down position.
- Sample a percentage of each job category as determined by IHD.
- If feasible, during the abatement job collect an excursion sample of approximately 30 minutes. This sample should be for the time period when highest asbestos fiber count is expected.
- At the end of each sampling period, remove the sampling pump from the employee, remove the sample cassette from the sample holder, and place sample in a labeled plastic bag and seal.
- Take personal air samples to Building 9995, Plant Laboratory Receiving.
- Have a completed chain of custody form signed by Plant Laboratory personnel upon receipt of samples.
- Postcalibrate personal sampling pump(s).
- Complete the IH sample information forms upon receipt of the final results from the Plant Laboratory.
- Notify IH Information Management to pick up the completed asbestos personal sampling results package.

Air Sampling - Area

Air asbestos samples may be taken in areas which are representative of work environments with airborne fiber concentrations that might reach the breathing zone of employees in these areas or in adjacent areas. The purpose of this sampling is to assure that asbestos is not being spread outside of regulated areas. Similar samples are collected when each asbestos job is finished to assure there is no significant residual concentration of asbestos fibers. The steps followed in area sampling are similar to those listed above for personal sampling. However, area samples are taken at a different sampling rate, and the sampling results are linked to an area rather than to an employee.

Sample Identification

Samples are not identified at the time they are sent to the analytical laboratory except as necessary to match the results with the correct sampling form. After results from the plant laboratory are received and converted to the reported concentration of fibers per cubic centimeters, the IHD technician enters the real identity of each sample on the sample form. This includes the material or environment sampled, sampling time, sampling location, and sampling technician. On personal samples, it also includes the name and identification number of the person being sampled.

SAMPLE ANALYSIS

Laboratory Analysis

Asbestos air samples are first analyzed with a screening method using PCM. This method does not differentiate among fiber types. If the fiber count by PCM cannot be determined or fibers other than asbestos are anticipated, asbestos fibers can be positively identified by Transmission Electron Microscopy.

The samples are processed by the LMES Analytical Services Organization (ASO) according to Procedure Y/P65-8537 Rev. D. This procedure lists the analytical apparatus used as positive PCM with green or blue filter, 8X to 10X eyepiece, 40X to 45X phase objective (total magnification ca 400X), and numerical aperture of 0.65 to 0.75; the regents and material used; and gives this brief description of the test method.

> The procedure determines the density and concentration of airborne fibers collected on a cellulose ester membrane filter. Phase contrast microscopy is used to locate the fibers which then are measured and counted. Sample collection, preparation, counting, and reported are done in accordance with Method 7400 NIOSH Manual of Analytical Methods. Fiber counting is performed in accordance with the ASO

Quality Control Procedure Y/P65-9509.

The ASO reports the total fibers counted, the number of fields counted, and the graticule field area for the microscope on which the count was made. From these parameters, and information on air flow rate through the filter, the number of fibers per volume of air can be calculated.

Quality Control (QC)

The QC group maintains a set of reference slides used on a daily basis when PCM is being performed. These slides consist of a range of fiber loadings and background dust levels from a variety of sources. The QC group uses the results of repeated counts on these slides to calculate intracounter and intercounter standard deviations for counts in the following ranges: 5 to 20 fibers, 21 to 50 fibers, 51 to 100 fibers in 100 graticule fields, and 100 fibers in <100 graticule fields.

Before each day's actual analytical counts, these reference slides are counted. The results of these counts must be reported to QC to obtain permission to proceed with routine microscopy. In addition, 10 percent blind recounts must be made by the same counting technicians. If a count and a recount disagree by more than the range prescribed by QC, a recount must be made of the ten remaining samples in the set.

Minimum Detectable Amount (MDA)

The standard deviation for the fiber counting procedure, as described in the previous section, can be used to statistically determine the MDA of counts. As a matter of policy, the ASO uses a number slightly greater than the calculated MDA as the minimum number of fibers they will report. This operational limit is referred to as the Lowest Count Reported (LCR) and is set at five fibers per 100 graticule fields.

USE OF RESULTS

Limits and Action Levels

Results from air asbestos samples are compared to the OSHA Permissible Exposure Limit (PEL). The limit for asbestos fibers for an eight-hour Time Weighted Average (TWA) concentration is 0.1 fiber/cm^3. The limit for short-term samples, referred to as the Excursion Limit, is 1.0 fiber/cm^3. Ordinarily the IHD has set plant action levels at one-half the PEL; however, in the case of asbestos, it has been determined that samples at such action level would not be statistically different from zero; therefore, no formal action level is declared. It is the policy of the IHD to investigate any sample that exceeds the recognized limit and help assure appropriate corrective action is taken.

Records

Laboratory results are reported to the IH technician who collected and submitted the sample(s). These results and information on the volume of air sampled are used to calculate the concentration of fibers in the sample in units of fibers/cc. This information, along with the sample identification data, is furnished to the IH Records Management section. Results and identification for personal samplers are entered in the Occupational Health Information System (OHIS).

Personal Sample Reporting

When results of personal sampling are available, a report is furnished to the employees involved through the supervisor. A copy of the report is signed by the employees and the supervisor to document that the report has been made available to the employees and that they have reviewed it. The results of the personal sampling are maintained in the OHIS from which reports can be generated in prescribed formats for any specified time (1987 to the present). However, requests for compilation of personal sampling results are rare; therefore, such reports are not done on a regular basis. Consequently, reporting of results other than that detailed here usually is not done.

Other Use of Results

On request from the Health Services Organization (HSO), the IHD furnishes any information they maintain on personal sampling. The HSO routinely requests such information on individuals just prior to the individuals' routine periodic physical examinations.

The results of area clearance air samples are reported to the job supervisor so action can be taken to further clean the area, or to release the area from its classification as an asbestos-regulated area if the results are sufficiently low.

PROGRAM COST AND RESULTS

Relative Program Cost

No absolute cost could be determined for the asbestos monitoring programs, but a relative cost estimate was made. This estimate showed the cost of the asbestos programs to be approximately 30 percent of the overall cost of the seven IH programs reported in this volume.

Summary of Recent Results

Table 1 presents personal asbestos monitoring results for the period since 1993. Note that the Y-12 Plant was in a stand-down mode for much of 1995 and that little asbestos work was done during this time. Table 1 also shows that only 1 of 341 samples collected exceeded the limit. Results for two kinds of personal air samples are shown in the table: (1) eight-hour TWA samples which are average exposures for a shift, and (2) excursion samples which are collected on individuals during a 30-minute period when the asbestos fiber concentration is likely to be the highest. Generally, excursion samples are collected in conjunction with longer samples and are included in the TWA. However, on a small short-term job, only an excursion sample may be collected.

Table 1. Asbestos Personal Air Sample Results

Period	Type	Number			Max	Concentration (Fibers/cc)	
	TWA/Excursion	Total	<LCR	>Limit		Average*	Limit
1994	8-hr TWA	70	55	0	0.078	0.023	0.1
	Excursion	69	54	0	0.485	0.196	1.0
1995	8-hr TWA	80	37	1	0.117	0.022	0.1
	Excursion	78	37	0	0.942	0.202	1.0
1996 to June 3	8-hr TWA	22	6	0	0.032	0.015	0.1
	Excursion	22	5	0	0.280	0.146	1.0
Total		341	200	1			

* The average is calculated from results that exceed the LCR.

PROGRAM EFFECTIVENESS

Evaluation

As indicated by the results, the air sampling programs are effective in determining air asbestos levels and helping assure that these levels remain well below those prescribed by OSHA. It is noted that almost 60 percent of the samples collected show less-than-detectable levels and that the average concentration in the remainder of the samples is approximately 20 percent of the limit. Only one sample out of approximately 350 exceeded the limit.

Observations

No reports are issued on the overall results of the programs or on how present data compare with previous data.

Recommendation

The IHD should consider the possible benefits to the department and the asbestos programs of providing routine reports of overall results to plant management to document how well asbestos exposures are being controlled and focus more attention on any exposure problems should they develop.

MAN-MADE MINERAL FIBER AIR MONITORING PROGRAMS

OVERVIEW

Purpose of Programs

Operated by Lockheed Martin Energy Systems, Inc. (LMES), for the U.S. Department of Energy, the Industrial Hygiene Department (IHD) at the Y-12 Plant in Oak Ridge, Tennessee, maintains an air sampling programs to help assure the plant meets regulatory requirements aimed at minimizing the exposure of plant personnel to Man-Made Mineral Fibers (MMMF).

Brief Description of Programs

The IHD assists and advises in the handling of materials that may contain MMMF and is also responsible for the monitoring of such materials to determine if they contain MMMF. In addition, the IHD has responsibility for collection of air samples for MMMF concentration. The sampling procedure involves drawing a known volume of air through a filter then viewing the filter under a microscope to determine the number of fibers present. The empirical fiber count is used to determine the number of fibers per unit volume of air (fibers/cc).

Exposure Potential

MMMF is a broad term for crystalline or noncrystalline synthetic silicon-based fibers which are classed into four broad groups: (1) continuous filament, (2) insulation wools, which includes rock wool, mineral wool, and glass wool, (3) ceramics, and (4) special purpose fibers. Many facilities in the plant have materials that contain MMMF. Consequently, when repair or renovations are made, material containing MMMF may be disturbed in a way that potentially generates airborne fibers.

Major projects that could result in generating such airborne fibers involve construction subcontractors. These contractors have responsibility for assuring that their employees, as well as Y-12 Plant employees, are not subjected to levels of MMMF that are above the limits established by IHD. Also, the construction contractors must assure that MMMF levels are no higher than necessary or would be expected if appropriate demolition safeguards were employed for each construction job. The Y-12 IHD is obligated to oversee such operations to the degree necessary to assure that no Y-12 employee is unduly exposed to these materials.

Purpose of Report

The purpose of this report is to describe the MMMF monitoring programs with particular emphasis on utilization of the generated results. This report is part of a larger volume aimed at documenting current radiological or chemical monitoring programs at Y-12 that may generate data useful for health and safety activities or studies.

PROGRAMS

General

The IHD is made aware of all new construction, renovation, or repair work that may involve exposures to chemical or physical toxicants. The IHD then evaluates the situation and determines if the planned activity may result in exposure potential for MMMF. If such exposure potential exists, the IHD provides guidance to maintenance or engineering personnel to assure that controls are in place to protect the workers' health. The IHD will also develop and implement programs as required to ensure that monitoring is performed in appropriate areas and on appropriate personnel to help assure that exposures to such fibers are controlled within acceptable levels.

Air Sampling

Personal Samples

Personal air samples are collected on representative employees who work in MMMF-regulated areas. These samples are taken in the breathing zone of such employees using a portable battery-powered pump connected to a filter paper holder. For more detail on how such samples are taken, please refer to the Air Sampling Personal topic of the Asbestos Air Monitoring Programs Report included within Volume II.

Area Samples

Samples may be taken in the MMMF areas which are representative of the air environments typically provided for MMMF workers. This type of sample is taken less frequently in these areas than in the Asbestos Regulated Areas.

Sample Identification

Samples sent to the laboratory are identified so the results of the analyses will be returned to the IHD technician who collected the samples. Upon receipt of the analytical data, the technician calculates the concentration of fibers in air and sends the results in a report to the IHD Records Section along with a complete sample and sampled worker identification information.

SAMPLE ANALYSES

Laboratory Analysis

Air samples for MMMF are analyzed using Phase Contrast Microscopy. This method does not differentiate between fiber types. Consequently, if further differentiation is required, analysis can be performed by electron microscopy. However, such situations have not happened. The analyses are performed by the LMES Analytical Services Organization (ASO) using their Procedure No. Y/P65-8337 Rev. D. in the same manner as are asbestos samples. (For more information see the Asbestos Air Monitoring Programs Report.)

Quality Control (QC)

For more detailed information on this method and the attendant QC program, please refer to the Laboratory Analysis and QC topics of the Asbestos Air Monitoring Programs Report.

Minimum Detectable Amount (MDA)

As a matter of policy the ASO uses an amount slightly greater than the MDA, as determined by the usual statistical means, as their Lowest Count Reported (LCR). The LCR for this method is five fibers per 100 graticule fields counted.

USE OF RESULTS

Comparison with Limits and Action Values

Results of the collected samples are compared to the established limits and action values so appropriate actions can be taken should they exceed these figures. The limits and action values used are shown below:

Table 1. Limits and Action Values (fibers/cc)

Material	Type Sample	Limit	Action Values
Fiberglass	8 hr. TWA	1.0	0.5
Fiberglass	Excursion	3.0	1.5
Other MMMF	8 hr. TWA	0.2	0.1
Other MMMF	Excursion	1.0	0.5

Y-12 IHD representatives set these limits based on a comparison with asbestos since the Occupational Safety and Health Agency does not establish Permissible Exposure Limits for these substances. The Y-12 Plant’s action values are set at half the limit values as a matter of IHD policy.

Informing Employees

When the results are available they are furnished to the involved employee through the supervisor. If required, an explanation or interpretation of the results is provided by the IHD. Results are also entered into the Occupational Health Information System where they are maintained for subsequent reports when needed.

Other Use of Reports

The IHD also provides results of MMMF sampling to the Health Services Organization. The results of area samples are reported to the job supervisors should there be any unexpected or elevated results. Other than the reports described here and in the previous topic, there is no other reporting of results outside of the IHD.

PROGRAM COST AND RESULTS

Program Cost

The MMMF monitoring programs are a relatively small part of the IHD programs. Although the precise cost of the programs has not been determined, the relative cost is estimated to be five percent of the total costs of the seven IH monitoring programs described in Volume II.

Summary of Recent Results

The following table shows the results from these programs since 1994. It is noted that the plant was in stand-down during much of 1995, and as a consequence, few operations were ongoing and few samples were collected.

Table 2. Summary of Recent Results

			Number			Results (fibers/cc)		
Year	**Type of Fiber**	**Type of Sample**	**Total**	**<LCR**	**>Limit**	**High**	**Average***	**Limit**
1994	Ceramic	8 hr TWA	8	3	0	0.06	0.02	0.2
	Ceramic	Excursion	8	3	0	0.56	0.26	1.0
	Fiberglass	8 hr TWA	9	5	0	0.10	0.05	1.0
	Fiberglass	Excursion	9	4	0	1.40	0.63	3.0
1995	Ceramic	8 hr TWA	8	1	0	0.02	0.02	0.2
	Ceramic	Excursion	7	1	0	0.38	0.30	1.0
1996	Ceramic	8 hr TWA	5	0	1	0.23	0.11	0.2
	Ceramic	Excursion**	5	0	3	3.60	1.62	1.0
	Fiberglass	8 hr TWA	6	1	0	0.06	0.03	1.0
	Fiberglass	Excursion	6	2	0	0.60	0.27	3.0

*Average dose not include samples less than the LCR.

**Samples were collected during removal of material with refractory ceramic fibers from large induction furnaces. Job has high exposure potential due to difficulty of providing localized ventilation and because wetting the material is not an effective method of control. Full-face respiratory protection was used on this operation. Recommendations have been made on improving local ventilation. Another set of personal air samples has been taken but the results are not yet available.

EFFECTIVENESS OF PROGRAMS

Evaluation

As indicated by the most recent sample results, all fiberglass samples are well within the plant limits. However, the 1996 ceramic fibers' results indicated average levels above the limit. Upon questioning, the program coordinator provided an adequate response regarding these elevated samples indicating that follow-up on over-the-limit samples was done in a timely and appropriate manner.

Observation

No reporting has been done on MMMF samples beyond the reporting of personal sampling results to the individuals.

Recommendation

Over-the-limit results should be reported in a manner that highlight the timeliness and degree of effectiveness of changes made to correct the problem.

CARCINOGEN AIR AND SURFACE SMEAR MONITORING PROGRAMS

OVERVIEW

Purposes of Programs

The Y-12 Plant in Oak Ridge, Tennessee, is currently managed by Lockheed Martin Energy Systems, Inc., for the U.S. Department of Energy. The Industrial Hygiene Department (IHD) at the Y-12 Plant operates Carcinogen Air and Smear Sampling Programs for the purposes of evaluating and assisting in the control of air and surface contamination in areas where carcinogens are being processed.

Brief Description of the Programs

The IHD manages Carcinogen Control Programs that are aimed at identifying and evaluating the potential hazard of possible carcinogenic materials. The IHD is also responsible for establishing control areas for handling of materials identified as carcinogens. Air samples are collected in these areas by drawing known amounts of air through cellulose filter paper. Smear samples are collected by wiping surfaces with cellulose paper. In both cases, these sampling papers are then analyzed for nickel or chromium making it possible to determine air concentrations in units of $\mu g/m^3$ or removable surface contamination in units of $\mu g/100\ cm^3$.

Exposure Potential

Most of the recent exposure potential to carcinogens has come from working with stainless steel containing nickel and chromium. A potential for air contamination with these two metals is created when stainless steel is sawed, sanded, or burned. In addition, there is a low potential for exposure to chromic acid used in the plant laboratory. A number of other materials used or produced in the Y-12 Plant, and which are known or suspected carcinogens, present very limited opportunity for exposure.

Purpose of Report

The purpose of this report is to describe the various facets of the Y-12 Carcinogen Control Programs and how the programs are operated. Nickel and chromium are used as examples since these are the only carcinogens monitored in the last 18 months, and special emphasis will be placed on the utilization of results. This report is part of a larger volume aimed at documenting all current monitoring programs at Y-12 that may generate data useful for health and safety activities or studies.

PROGRAMS

The IHD works with plant supervision to minimize carcinogen use in the plant and to properly evaluate operations in which they are used. This evaluation is a formalized risk assessment using the Carcinogen Use Information Form as shown in Figure 1.

CARCINOGEN USE INFORMATION

Building ____________ Floor/Area ____________ Room/Subarea ____________

Supervisor ____________ Phone ____________ Organization ____________

Operation Title ____________ **Task** ____________

Circle correct answer:

Substitute Available: Yes No **Controls in Place:** Enclosure/Isolation Glove Box Lab Hood Wet Methods Shielding Personal Protective Equipment

Frequency/Exposure Time:

Frequency of Use: Daily Weekly Monthly < Monthly

Frequency per 8 Hr Shift: Continuous Intermittent Occasional Other Exposure time per 8 Hr Shift: ________ Hours

Carcinogen(s) Used:

Product ____________ Agent (1) ____________

Product ____________ Agent (2) ____________

Product ____________ Agent (3) ____________

Supervisor ____________ Date ____________

CARCINOGEN RISK ASSESSMENT

Review of Sampling Data:

	8 Hr TWA *Action Level*	Data on file	> Limit	Ceiling/STEL	Data on File	> ½ Limit
Agent (1)	________	*Yes No*	Yes	________	*Yes No*	Yes
Agent (2)	________	*Yes No*	Yes	________	*Yes No*	Yes
Agent (3)	________	*Yes No*	Yes	________	*Yes No*	Yes

Assessment: (Yes) requires attention prior to and while conducting the task [see Notes/Comments Section and/or Carcinogen Use Plan]

Sampling Yes No Controls Yes No Work Methods Yes No OSHA STD Yes No Other Yes No

Exposure Risk:

Negligible ☐ Potential ☐ Significant ☐

Notes/Comments:

Industrial Hygienist ____________ Date ____________

Figure 1. Carcinogen Use information Form

If the risk assessment indicates a significant potential for carcinogen exposure, the IHD develops an appropriate Carcinogen Use Plan (Figure 2). This plan may specify that air and smear samples are to be collected as part of the monitoring protocol.

CARCINOGEN USE PLAN

Building ____________ Floor/Area ____________ Room/Subarea ____________

Supervisor ____________ Phone ____________ Organization ____________

Use Plan Identifier: ____________ **Operational Status:** **Active** [ ] **Inactive** [ ]

Operation Title ____________ **Task** ____________

Area Designation: **Carcinogen Regulated Area** [ ] **Carcinogen Use Area** [ ]

Additional Requirements for Carcinogen Use Areas: *Complete for Carcinogen USE AREAS ONLY*

In addition to the Procedural Requirements for Carcinogen Use Areas, the following marked sections of ESS-IH-139 Appendix A, Procedural Requirements for Carcinogen Regulated Areas are necessary to fulfil ALARA Requirements: *Mark appropriate box(es)*

Exhaust Air - Primary [ ]	**Exhaust Ventilation** [ ]	**Housekeeping** [ ]	**Shower Facility** [ ]
Eye Wash Facility [ ]	**Handwashing Facility** [ ]	**Area Identification** [ ]	**Respirator Use** [ ]
Decontamination [ ]	**Work Surfaces** [ ]	**Vacuum Lines** [ ]	**Chemical Transport** [ ]

Controls: *Circle Required Controls*

Gloves: Butyl Latex Leather Neoprene Nitrile Vinyl Surgical ____________

Eye/Face: Full Face Shield Laser Eyewear Splash Goggles Safety Glasses Welding Goggles Welding Helment ____________

Respirator: Full Face (NP) Half-Face (NP) PAPR Blasting Hood Supplied Air-Line SCBA ____________

Hearing: Canal Caps Earplugs Muffs Limit Time Helments ____________

Body: Apron Coveralls Tyvek Suit Lab Coat Belt/Harness Heat Reflective Full Body Suit ____________

Head/Foot: Hard Hats Safety Shoes Tyvek Hood Shoe Covers Metatarsal Guard Impermeable Boots ____________

Engineering Controls: Enclosure/Isolation Glove Box Lab-Hood Local Exhaust Wet Methods Shielding

Other: Procedures Process Change Substitution Work Methods

OSHA 1910.__________ regulates the use of this carcinogen. See Additonal Remarks.

Sampling: Initial Sampling Required Yes No Routine Sampling: Breathing Zone Smear

Frequency: ____________ ____________

Additional Remarks: Requirements Recommendations Comments Procedural Variances OSHA Requirements

[ ] Continued on Other Side

Industrial Hygienist ____________ Date ____________

F

i g u r e 2 . Carcinogen Use Plan Form

It should be noted that the carcinogens control procedure does not apply to some of the materials in Y-12 that are known to be carcinogens because separate procedures and programs are maintained for their control. These materials include beryllium, lead, asbestos, and man-made mineral fibers. Programs for these materials are covered in other reports within this volume. The remainder of this report will be aimed at describing in detail the programs that relate to other carcinogens.

Personal Air Sampling

If the Carcinogen Use Plan calls for air sampling, personal breathing zone samples will be collected. The personal air sampling program uses a battery-powered, portable pump attached to the belt of an employee. The pump draws approximately two liters of air per minute through a hose attached to a filter holder to monitor the breathing zone of the monitored employee. (The steps for collecting such samples are described in more detail in the Beryllium Air and Smear Monitoring Programs Report within this volume.)

Participants in this program are those employees who work in carcinogens-regulated areas. Their names are furnished to Health Services Organization and the IHD by supervisors, by using the Carcinogen Authorized Personnel List. Employees judged to have significant exposure potential while working with or around carcinogens are sampled. The organizational IH designates when such personal samples are to be collected, and the samples are then collected by an IH technician.

Smear Sampling

Two types of surface smear samples are collected. The first type is used to evaluate and assist in contamination control in a carcinogen-regulated or carcinogen-use area. The second type is used to evaluate equipment and material designated for transfer to a nonregulated area or an offsite part of a carcinogen-regulated area. This assures that the identified equipment or material does not have significant carcinogen contamination.

Sample Identification

Each carcinogen monitoring sample is identified for submission to the analytical laboratory only to the extent necessary to link the laboratory results to the correct sample. The detailed identity of the sample, including where, when, and by whom the sample was taken, is contained in the Industrial Hygiene Sample Information Form. The name and identification number of the person sampled are documented for personal samples. This form goes to the IH Information Management Section, and the information is entered into the Occupational Health Information System (OHIS). From this information system, reports can be prepared based on the results of the samples.

SAMPLE ANALYSIS

After collection, the air or surface smear samples are transported by the IH technician who collected the samples to the Analytical Services Organization (ASO) for analysis. The samples are transferred to ASO personnel who sign for them to maintain the chain of custody.

Once the samples are received, they are analyzed according to Y-12 Procedure Y/P65-0017 Rev. A using Inductively Coupled Plasma - Optical Emission Spectrometry (ICP-OES). This procedure lists reagents and materials as well as apparatuses. Among the apparatuses listed in Y/P65-0017 is an ICP-OES with appropriate computer interface. Both nickel and chromium are analyzed using the same procedure which is summarized as follows:

> Air and smear samples collected on filter media are solutioned using nitric acid (HNO_3) and heat. Hydrochloric acid (HCl) is added for some elements. An Internal Reference Element (IRE) is added to this solution. Simultaneous multi-element determination is performed on an ICP-OES. The method measures emission by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element specific atomic emission spectra are produced by a grating spectrometer, and the line intensities are monitored by photo multiplier tubes. Data collection and appropriate calculations are performed by a computer.

Once the ASO acquires their results, they are forwarded to the IH technician who collected the samples who then calculates the concentration of these elements per unit volume or area.

Quality Control (QC)

As previously noted, each sample submitted to the laboratory has a reference element added to it. If the measurement for this known spike is less than 80 percent or greater than 120 percent of the expected value, all likely causes are investigated. Necessary adjustments or comments are made and documented. If the blank value is greater than the level established by the laboratory as the Lowest Reporting Level (LRL), and can be traced to reagents, then any necessary corrections are made and documented. If the results from the check standards are more than three standard deviations from the established mean, a serious problem with the calibrations is indicated. Such a situation may require that the batch be rerun after the cause of the problem has been identified and corrected. ASO Procedure Y/P65-0017 includes a QC statistic for nickel but not for chromium. Results of 23 filters, spiked with known amounts of nickel, showed a bias of +6% and a standard deviation of ±1.7%.

Minimum Detectable Amount (MDA)

The ASO generates the appropriate information required to calculate the MDA for nickel and chromium by the usual methods. However, it is the policy of the ASO to establish an LRL that is higher than the MDA. The ASO states in Procedure Y/P65-0017 that the LRL for nickel is 0.5 microgram per filter, and the LRL for chromium is 0.1 microgram per filter.

UTILIZATION OF THE DATA

Limits and Action Points

As shown in Table 1, results of analyses for carcinogens are compared to the limits and action levels used at Y-12. These limits are adopted from those published by the American Conference of Governmental Industrial Hygienists and are consistent with those recommended by the Occupational Safety and Health Administration. As a matter of policy and practice, the Y-12 Plant action levels are set at one-half the limits established by these authorities. This approach to establishing action levels has been successfully used for many years within Y-12.

Table 1. Limits and Action Points in Time Weighted Averages (mg/m^3)

Element	Limit	Action Levels
Nickel	0.1	0.05
Chromium Metal	0.5	0.25
Chromium (VI) Compounds	0.05	0.025

Reporting of Results

The results of personal air sampling for carcinogens are reported to the individual sampled through the supervisor. The worker and the supervisor sign the report sheets, verifying the worker has been shown the sampling results. The results are also made available to the Medical Director if they exceed the established limit. Any results can be made available to the Medical Director upon his request. In turn, the Medical Director will notify the IH staff of all suspected or diagnosed occupational illnesses.

The data generated by this program are currently maintained in a computerized format in the OHIS. Reports from these data can be produced for any selected time period; however, it is understood that such reports are seldom prepared. No reporting other than that just described is routinely done.

Brief Summary of Recent Results

Table 2 shows nickel and chromium analysis results since 1994. As stated earlier, nickel and chromium samples were the only carcinogen samples collected during this period.

Table 2. Personal Air Sampling Results for Ni and Cr

		Number			Results (mg/m^3)		
Period	**Type**	**Total**	**<LRL***	**>Limit**	**High**	**Average****	**Limit**
1994	Ni 8-hr TWA	5	4	0	0.0011	0.0011	0.1
1994	Cr 8-hr TWA	7	3	0	0.0011	0.0004	0.5
1995	Ni 8-hr TWA	6	6	0	-	-	0.1
1995	Cr (VI) 8-hr TWA	1	1	0	-	-	0.5
1995	Cr 8-hr TWA	5	2	0	0.001	0.0001	0.5
1996	Ni 8-hr TWA	1	1	0	-	-	0.05
1996	Cr 8-hr TWA	0	-	-	-	-	-

* Less than the lowest concentration reported.
** Average does not include samples with results <LRL.

The information in Table 2 was obtained from the supervisor of Information Management Systems. Although the latest procedure calls for smear sampling results, according to the manager of the carcinogen programs, no such samples were collected during the periods reported above.

SIZE AND COST OF PROGRAMS

The Carcinogen Air and Smear Monitoring Programs are small as evidenced by few samples being taken during the past 2-1/2 years. Only 65 employees on the Medical Surveillance Programs are listed as carcinogen workers. It is likely that even fewer employees will be classified as carcinogen workers when a newly planned procedure is implemented in early August. The new procedure emphasizes regulatory oversight of the programs and will minimize the number of employees classed as carcinogen workers. The new procedure will restrict that classification to workers who work in areas where there is significant risk of having airborne concentrations or surface contamination at or above the respective action levels. It is estimated that the expense of these programs is less than five percent of the cost of the seven IH monitoring programs reported in this volume.

PROGRAM EFFECTIVENESS

Evaluation

Based on the limited personal air samples collected for this program, control of carcinogen exposure appears to be good. Sixty-four percent of the samples collected were below the detectable level, and the average of the remaining samples was less than one percent of the limit.

Observations

1. Potential for exposure to carcinogens is low, as judged from results of recent personal air samples.

2. Of 65 employees presently classed as carcinogen workers on the Medical Surveillance Programs, only a small fraction have had personal air samples recently.

3. A recently issued (not yet implemented) procedure will minimize the number of workers classified as carcinogen workers by restricting that category to employees with significant risk of exposure to carcinogenic substances.

Recommendation

The IHD should work with the medical, operating, and maintenance departments to assure that only persons meeting the criteria defined by the newly issued procedures are classed as carcinogen workers.

OTHER INDUSTRIAL HYGIENE MONITORING PROGRAMS

OVERVIEW

The information presented in the Industrial Hygiene Department (IHD) section of this document (Volume II) are for those monitoring programs that were active during the 1995-1996 period and that have designated program coordinators. The IHD also provides monitoring or surveillance for some chemical toxicants that are not widely enough used to have dedicated programs or to have a program manager. Three such materials sampled during this 1995-1996 period were thallium, silica, and cobalt. Rather than describing the sampling and analysis of these materials as programs, the procedures followed by the IHD in discovering that such materials are to be processed, and a general description of subsequent actions taken to monitor for possible exposure, are presented. The descriptions in this report will also apply to the air sampling programs covered in other reports in this volume.

INFORMING THE IHD

Before IHD staff can monitor for exposure to any toxic material, they must have knowledge that the material is being handled in the plant. Several means by which this information can come to their attention are listed below:

- Plant Procedure Y70-526 *Health and Safety Readiness Review*. This procedure requires that engineering and operational representatives work with health and safety representatives to provide guidelines for safety and health planning to ensure problem recognition and resolution for any new or revised facility. During these contacts, the IHD would learn if any toxic substance is to be used or produced in the new or revised facility.

- Plant Procedure Y70-200 *Industrial Hygiene*. This procedure requires that development, production, and maintenance supervisors ensure that healthful working conditions are maintained within their organizations, and that industrial hygiene recommendations are implemented. Consequently, adherence to this procedure results in supervisors checking with the IHD about possible toxic materials that may be handled in future operational tasks. In addition, this procedure makes the IHD responsible for maintaining a hazardous materials tracking system. To the degree that such a system is well maintained, the IHD should know of any use of hazardous materials in the plant.

- Plant Procedure Y70-043 *Job Hazard Analysis* requires line management personnel to recognize potential hazards that may require involvement of the IHD, and this recognition will prompt notification of the IHD.

- Plant Procedure 70-379 *Construction Contractor - Site Characterization and Worker Requirements*. This procedure requires that an industrial hygiene checklist (Figure 1) be completed to alert the IHD to any hazardous materials expected to be used in planned construction.

Area of Concern:	Current Process		Construction		Comments:
	Yes	No	Yes	No	
Asbestos					
Nonasbestos Fibrous Insulation					
Beryllium/Lithium/Heavy Metals					
Mercury					
Carcinogens					
Welding/Brazing/Cutting					
Abrasive Blasting/Dusty Operations					
Confined Space Entry					
Noise in excess of 85 dBA					
HAZCOM: MSDS's Available					
Temperature Extremes					
Non Ionizing Radiation					
HAZWOPER Site					
Other Hazards (Biohazards, Oils, PBC, Acids,Caustics, Organics, Coatings)					Other Concerns/Comments:
Personal Protective Equipment Required Now During Operations:					

☐ Respirator: (check all that apply)

☐ ½ face ☐ Fullface ☐ Hood

☐ SCBA ☐ Supplied Air

☐Cartridge Type:________________ ☐ Goggles

☐ Gloves Type__________

☐ Tyvek Suit ☐ Coveralls

☐ Full Encapsulating Suit

☐ Hearing Protectors

Figure 1. Industrial Hygiene Potential Hazard Checklist

In addition, Procedure 70-375 *Construction Contractor - Safety and Health*, requires a Safety and Work Requirements Checklist which includes the following questions among those listed for industrial hygiene in Appendix A of that procedure:

- Is asbestos removal required?

- Is monitoring for gases and fumes required?

- Are nonradiological hazardous sources involved?

The answers to these questions should alert the IHD about the use of any materials which would be of IH concern.

- Plant Procedure 70-525 *Operational Work Permits*. This procedure requires that an Operational Safety Work Permit be completed anytime a Maintenance Work Request is submitted. This Safety Work Permit includes a question requiring the supervisor to indicate if the IHD is to be contacted for consultation. A signature space is also provided on the permit for the IHD representative to indicate that a review of the situation has been performed and the site of the work plan has been examined. Such requirements should help assure that the IHD is alerted to any toxic substances involved in maintenance operations.

- Plant Procedure Y70-050 *Respiratory Protection Program* will alert the IHD to any hazardous material that is being processed, or will be processed, when plant supervisors send employees expected to work with such materials to the respiratory fitting facility which is managed by the IHD.

- Plant Procedure Y70-220 *Occupational Exposure to Hazardous Chemicals in Laboratories* requires a documented work plan for any chemically hazardous material handling in laboratories. This plan must be approved by the IHD who will thereby be notified concerning the hazardous material.

- Plant Procedure Y70-750 *Confined Space Entry* requires that the IHD be notified of planned entry into any confined space. Since the IHD administers this program, they would be alerted to any new or unusual chemical toxicants that may be involved in these entries.

The plant procedures pertaining to IH programs described in other chapters of this volume also require notification to the IHD of any known or potential exposure to the hazardous material discussed in the chapter.

PROGRAMS FOR AIR SAMPLING

A number of programs exist for sampling of general, operational, or breathing zone air. Depending on the toxic material of interest and the operation involving the toxic material, a request to conduct air sampling or monitoring may be assigned to an organizational or program industrial hygienist. For example, in the case of carcinogens, the monitoring task may be assigned to the Carcinogen Program Industrial Hygienist or to the Industrial Hygienist assigned to the organization performing the operation.

Consequently, either the program or the organizational IH will receive the formal request for monitoring or will otherwise become aware of an operational situation that may require sampling for chemical toxicant(s). After evaluating the request or situation, if sampling is indicated, the responsible IH will complete a Field Request Form (FRF) to send to the Site Support Group Supervisor or to the IH Technician assigned to the responsible IH. The FRF may contain the following information.

- Requestor ID number, date, location, and agent to be sampled.
- Specified sampling strategy giving sample methodology, material stability and/or retention time, duration and frequency of sampling, and employees to be sampled if known.
- Potential safety and health hazards.
- Personal protective equipment required to conduct sampling.
- Contact and telephone number.
- Deadline for analysis.

The IH Technician or the IH Laboratory Coordinator is also responsible for notifying the Y-12 Plant Laboratory of any upcoming sampling to ensure that analytical support is available. A published statement of work exists between the Plant Laboratory and the IHD that designates analyses for which the Plant Laboratory has developed procedures. An IH Laboratory Information Manual issued 12/05/95 lists 37 materials for which the Plant Laboratory has analytical capability. If no developed procedure exists within the plant laboratory for a required analysis, prior arrangements are made to have the proposed samples analyzed by a commercial laboratory.

Upon receipt of the FRF the Site Support Group Supervisor or responsible IH will take the following steps:

- Review request for completeness.
- Assign air sampling request to field sampling technician when needed.

- Forward a copy of the FRF to the technician assigned to conduct sampling.
- Track progress of the requested sampling if customer has requested a short turnaround of the analysis.
- Recalculate all results appearing to be at or above applicable limits before issuing any report or recommendations.

Once the FRF request is assigned to a field sampling technician, the following actions will be taken:

- Review FRF.
- Contact appropriate personnel to schedule times for sampling.
- Ensure that the sampling pump battery is fully charged.
- Calibrate the pump to a flow rate specified in sampling procedure for the specific contaminant(s) of interest and document in calibration logbook.
- Inform worker(s) to be sampled of the purpose of the sampling.
- Collect pertinent sampling data and demographic information from employee(s) to be sampled (name, address, badge number, SSN, and work area), and enter this data on appropriate Sampling Area Monitoring (SAM) forms (Figures 2-6). Note: Each form has an attendant glossary of terms that is not shown here.
- Position the pump(s) to minimize discomfort for the employee(s) and minimize interference with normal work activities.
- Position sampling media in the worker's breathing zone (within 9 inches of nose/mouth).
- Instruct worker to periodically check to verify that pump is operational, and if not, notify the supervisor.
- Start pump and record the start time.
- Inspect the pump as feasible and record time of inspection.
- Observe and summarize employee work activity and record on the SAM form.

Field Sampling Request Form

Form ID SAM-1

*A Charge to Account	*B Requestor Name	*C Badge (*Requested by*)	*D Date	E Request ID

F Assigned Technician ____

*G Sample Location(s) ____

H Operation ID/Title ____

I Exposure Group ID/Title ____

*J Sample Date(s)/Time ____ K Contact/Supv. ____ L Phone ____

M Organization ____ N Analysis Needed By ____

*O
____
____
____
____
____
____
____

Description of Sampling Request

P **Sampling Rationale**
- ☐ Compliance
- ☐ Routine
- ☐ Special Purpose

Q *Area and Personal Air Sampling*

☐ Anasorb Tube	☐ Passive Sampler	☐ Century OVA 128 GC	☐ PM-7700
☐ Charcoal Tube	☐ Silica Gel Tube	☐ Drager Gas Detector	☐ Sensidyne Gas Detector
☐ Color Detector Tube	☐ XAD Tube	☐ Jerome 411	☐ ____
☐ Cyclone	☐ ____	☐ Jerome 431X	☐ ____
☐ Filter Cassette 25 mm	☐ ____	☐ Miran 1B	☐ ____
☐ Filter Cassette 37 mm	☐ ____	☐ 580 OVM PID	☐ ____
☐ Hopcalite Tube	☐ ____		
☐ Impinger	☐ ____	R *Flow Rate (l/m)*	S *Minimum Volume (l)*

*T *Elims Code*	U *Agent for Lab to Analyze*

Bulk

*T *Elims Code*	U *Agent for Lab to Analyze*

Smear

*T *Elims Code*	U *Agent for Lab to Analyze*	V *Surface Area cm²*

Water

*T *Elims Code*	U *Agent for Lab to Analyze*

W **Equipment to be used**

Noise
- ☐ Quest 215 SLM
- ☐ Quest M-27 Dosimeter

Confined Space
- ☐ MSA 260
- ☐ GX 4000 Forerunner

Heat Stress
- ☐ Botsball
- ☐ Wibget
- ☐ Quest II Ear Probes
- ☐ Thermoscan Pro-1

Chlorine
- ☐ HACH DR100

Indoor Air
- ☐ AQ 501
- ☐ Alnor Thermal Anemometer (velocity)
- ☐ Andersen Sampler (biological)
- ☐ Fibrous Aerosol Monitor (FAM)
- ☐ Handheld Aerosol Monitor (HAM)

Rel. Humidity
- ☐ Bacharach Sling

Lighting
- ☐ Greenlee 93-1065

Lead Content
- ☐ Niton XL

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* Required Field

Figure 2. Form ID SAM-1

Form ID SAM-3

Sampling Location * A Facility Floor/Area Room/Area	**Survey** * B **Date**
	* C **Total # Samples** (include blanks)
Sampling Person * D Name Badge/ID	E **ID**

Complete for ALL Samples

Sample ID F*		
Pump ID G		
Coordinate H* Describe exact location of sample		
Type I*	☐ Area ☐ Clearance ☐ Spike ☐ Blank ☐ BZ	☐ Area ☐ Clearance ☐ Spike ☐ Blank ☐ BZ
Time J* Total in Minutes	Start AM PM Stop AM PM Total Min.	Start AM PM Stop AM PM Total Min.
Flow Rates K* Liters/Minute	Pre- l/min Post l/min Average l/min	Pre- l/min Post l/min Average l/min
Total Volume L* Liters	liters	liters
Agent(s) M*	☐ Multiple Agents Attached	☐ Multiple Agents Attached
Lab Results N* ug or fiber/field	☐ micrograms (ug) ☐ fiber/field (f/field)	☐ micrograms (ug) ☐ fiber/field (f/field)
Concentration O*	☐ milligrams/cubic meter ☐ fibers/cubic centimeter	☐ milligrams/cubic meter ☐ fibers/cubic centimeter

Only for PEOPLE Samples

Name P*		
Badge or SSN Q*		
Type R*	☐ TWA ☐ Excursion ☐ STEL ☐ Ceiling	☐ TWA ☐ Excursion ☐ STEL ☐ Ceiling
Activity S* Description of task person was doing while wearing sample		
Respirator T*	☐ Full Face ☐ Blast Hood ☐ Half Face ☐ Supplied Air ☐ PAPR ☐ SCBA ☐ ________ ☐NONE	☐ Full Face ☐ Blast Hood ☐ Half Face ☐ Supplied Air ☐ PAPR ☐ SCBA ☐ ________ ☐NONE
Cartridge U*	☐ HEPA ☐ Combination HEPA/Chemical ☐ Chemical ☐ Combination HEPA/Mercury ☐ Mercury ☐ HF ☐ ________ ☐NONE	☐ HEPA ☐ Combination HEPA/Chemical ☐ Chemical ☐ Combination HEPA/Mercury ☐ Mercury ☐ HF ☐ ________ ☐NONE
Gloves V	☐ Nitrile ☐ Surgical ☐ Latex ☐ Neoprene ☐ Leather ☐ ☐ Vinyl ☐ Butyl ☐ ☐ ________ ☐NONE	☐ Nitrile ☐ Surgical ☐ Latex ☐ Neoprene ☐ Leather ☐ ☐ Vinyl ☐ Butyl ☐ ☐ ________ ☐NONE
Eye/Face W	☐ Safety Glasses ☐ Welding Helmet ☐ Full-Face Shield ☐ Welding Goggles ☐ Splash Goggles ☐ Laser Eyewear ☐ ________ ☐NONE	☐ Safety Glasses ☐ Welding Helmet ☐ Full-Face Shield ☐ Welding Goggles ☐ Splash Goggles ☐ Laser Eyewear ☐ ________ ☐NONE
WholeBody X	☐ Coveralls ☐ Full Body Suit ☐ Tyvek Suit ☐ Heat Reflective Suit ☐ Apron ☐ Lab Coat ☐ ________ ☐NONE	☐ Coveralls ☐ Full Body Suit ☐ Tyvek Suit ☐ Heat Reflective Suit ☐ Apron ☐ Lab Coat ☐ ________ ☐NONE
Hearing Y	☐ Ear Plugs ☐ Muffs ☐ Ear Plug/Muff Combination ☐ ________ ☐NONE	☐ Ear Plugs ☐ Muffs ☐ Ear Plug/Muff Combination ☐ ________ ☐NONE
Notes Z		

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* Required Field

Figure 3. Form ID SAM-3

Employee Daily Exposure Assessment Record

Form ID SAM-4

* A Employee Name	* B Badge / SSN	* C Sample Date

* D Assessment Type (select one) ☐ Air ☐ Heat Stress ☐ Noise ☐ Biological	* E Result Type ☐ 8-Hour TWA ☐ 10-Hour TWA ☐ Sample Assessment Only

* F Exposure Agent (spell out)	* G TWA Result	* H Limit	* I Unit ☐ mg/m³ ☐ dBA ☐ f/cc ☐ ____

Sample Specific Information

* J Sample TWA	* K Limit	* L Sample TWA Type (select one) ☐ Excursion ☐ Ceiling ☐ STEL ☐ ____	M Notes

* N Survey ID ☐ * O Sample ID ☐	* P Facility / Floor/Area / Room/Area * Q Operation ID/Title ☐ R Exposure Group ID/Title ☐

* S PPE Used

T Engineering Controls Used

* J Sample TWA	* K Limit	* L Sample TWA Type (select one) ☐ Excursion ☐ Ceiling ☐ STEL ☐ ____	M Notes

* N Survey ID ☐ * O Sample ID ☐	* P Facility / Floor/Area / Room/Area * Q Operation ID/Title ☐ R Exposure Group ID/Title ☐

* S PPE Used

T Engineering Controls Used

U Represented Persons Represented persons are people who were not directly sampled, but who were exposed in exactly the same way and manner as the person who was sampled. Do not list represented people if they were not ONE-ONE with the sampled person at all times.

Employee Name	Badge / SSN	Employee Name	Badge / SSN

V Corrective Action This section should briefly describe or identify documents which describe the corrective actions taken for OVER-EXPOSURES.

* Required Field

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Figure 4. Form ID SAM-4

Figure 5. Form ID SAM-7

Form ID SAM-10

Sampling Location * Facility Floor/Area Room/Area A	* B **Date** * C **Total # Samples** (include blanks)
Sampling Person * Name Badge/ID D	**Survey** **ID** E

* F Area Code / Loc Code	* H Start Date	* J Time ☐am ☐pm	* L Total Time (Minutes)	M Result (ugs)
G Sample ID	* I Stop Date	* K Time ☐am ☐pm		
N Specific Location Description				

* F Area Code / Loc Code	* H Start Date	* J Time ☐am ☐pm	* L Total Time (Minutes)	M Result (ugs)
G Sample ID	* I Stop Date	* K Time ☐am ☐pm		
N Specific Location Description				

* F Area Code / Loc Code	* H Start Date	* J Time ☐am ☐pm	* L Total Time (Minutes)	M Result (ugs)
G Sample ID	* I Stop Date	* K Time ☐am ☐pm		
N Specific Location Description				

* F Area Code / Loc Code	* H Start Date	* J Time ☐am ☐pm	* L Total Time (Minutes)	M Result (ugs)
G Sample ID	* I Stop Date	* K Time ☐am ☐pm		
N Specific Location Description				

* F Area Code / Loc Code	* H Start Date	* J Time ☐am ☐pm	* L Total Time (Minutes)	M Result (ugs)
G Sample ID	* I Stop Date	* K Time ☐am ☐pm		
N Specific Location Description				

* F Area Code / Loc Code	* H Start Date	* J Time ☐am ☐pm	* L Total Time (Minutes)	M Result (ugs)
G Sample ID	* I Stop Date	* K Time ☐am ☐pm		
N Specific Location Description				

Revision 2 04-29-96

* Required Field

Figure 6. Form ID SAM-10

- Set up appropriate controls. Field blanks must come from the same lot as actual samples and should be handled in the same way as samples except that no air is drawn through blanks. Ends of the blank tube or filter cassette should be opened at the sampling site, then immediately closed.

- Stop the pump at the end of sampling period and record the time.

- Follow any special handling requirements specified in FRF.

- Complete a chain of custody form (Figure 7).

- Complete documentation of sampling.

- Submit sampling media to Plant Laboratory for analysis. Note: IH Technicians usually deliver the samples to the laboratory and the ASO Manager arranges for hand delivery of the air sampling results to the technicians.

- Track progress of samples being analyzed by use of the Laboratory Information Management System.

- Calculate air concentration when the hard copy results are received from the laboratory.

- Compare results to American Conference of Governmental Industrial Hygienists or Occupational Safety and Health Administration limits and action levels and report any results exceeding established limits to supervisor and IH requestor.

- Submit sampling information to IH Information Management Group (IHIM).

Once samples are collected and the laboratory results are available, the responsible IH:

- Reviews data and checks results of air sampling performed by field sampling personnel.

- Notifies the appropriate supervisor of any sample exceeding applicable limits.

- Formally notifies sampled personnel and their supervisor(s) of sampling results.

The IHIM is responsible for the following:

- Checking air sampling information for completeness and accuracy.

- Providing data entry and report generation services.

- Providing formal reports to industrial hygiene requestor, along with original air sample information package for approval and signature.

- Retrieving original forms and maintains records file.

Survey Samples Chain of Custody Form ID SAM-12

Initiated by: ________________ Building/MS: ________________ Phone No: _________

Date Sampled	Laboratory ID	No. of Samples	Type Of Sample	Analysis Requested	Comments or concerns
			☐ Air ☐ Smear ☐ Water ☐ Bulk ☐ ____________		
			☐ Air ☐ Smear ☐ Water ☐ Bulk ☐ ____________		
			☐ Air ☐ Smear ☐ Water ☐ Bulk ☐ ____________		
			☐ Air ☐ Smear ☐ Water ☐ Bulk ☐ ____________		
			☐ Air ☐ Smear ☐ Water ☐ Bulk ☐ ____________		
			☐ Air ☐ Smear ☐ Water ☐ Bulk ☐ ____________		

Relinquished by Signature:	Date | Time	Received by Signature:	Date | Time	Building	Phone No.

Revision 2 04-29-96

* Required Field

Figure 7. Form ID SAM-12

PROGRAMS FOR BIOLOGICAL SAMPLING

If the toxic material of interest is one for which a biological substance may be sampled as an index of exposure, it is the responsibility of the program IH or organization IH to arrange through Plant supervisors for the establishment of such monitoring programs. It is also necessary for the responsible IH to arrange for the Plant Laboratory or an outside laboratory to analyze these samples.

THE MEDICAL SURVEILLANCE PROGRAMS

OVERVIEW

Purpose

The Health Services Organization (HSO) of the Oak Ridge Y-12 Plant maintains a database to identify employees who have the potential to be exposed to chemical and radiological hazards in the workplace and to help ensure they receive required medical surveillance. The Y-12 Plant is operated for the U.S. Department of Energy by Lockheed Martin Energy Systems, Inc., (LMES).

Brief Description of Programs

Plant supervisors determine periodically which employees have potential for exposure to radiological or chemical hazards. A formal report is submitted as required by LMES Procedure Y-70-036, "Identification of Employees Requiring Medical Surveillance." The HSO maintains a list of the employees who have been identified by their supervisors as requiring medical surveillance examinations and provides the names of employees who have completed exams to the Training Management System (TMS). The HSO also maintains a list of employees who fail to pass the physical or who have not reported for scheduled physicals and are, therefore, restricted from working with materials requiring worker medical surveillance on the TMS.

Purpose of Report

The purpose of this report is to describe the Medical Surveillance Programs in detail with emphasis on how information from these programs can be used to identify employees with exposure potentials. This report is also part of a larger volume aimed at documenting all currently installed monitoring programs at Y-12 that may generate data useful for health and safety activities or studies.

PROGRAMS

General

The Medical Surveillance Programs were established by Procedure Y10-036 which specifically states that employees who work with radiological, chemical, or physical hazards are to have medical surveillance coverage. Some of the listed hazards will not be discussed in this report since they are for physical stress, or they are substances that were not used at Y-12 in the 1995-1996 period. The Medical Surveillance Programs cover individuals for potential exposures other than those listed in Y10-036. For example, medical surveillance is required for some employees who formerly were asbestos, beryllium, or centrifuge process workers. Other employees are certain truck drivers, welders, firemen, and security police.

Personnel Covered

The following employees are regularly covered by the Medical Surveillance Programs. Among these are employees that work with material for which there are monitoring programs described in other reports within these volumes. Definitions for these workers, as provided in Procedure Y10-036, are included along with respirator wearers and toxic hazardous substance workers.

- ***Asbestos Worker***. Any employee assigned to work involving the intentional disturbance of asbestos fibers, informed of mandatory requirements, and trained in accordance with the Occupational Safety and Health Administration standards is classified as an asbestos worker.

- ***Beryllium Worker***. Any person whose work assignment requires frequent entry into a regulated beryllium area is classed as a beryllium worker. The following frequency guidelines are suggested to assist supervisors in identifying beryllium workers: $\geq$ 4 times any 1 month; $\geq$10 times any 1 quarter; $\geq$ 15 times any 6-month period; or $\geq$ 25 times any 1-year period.

- ***Carcinogen Authorized Personnel***. An employee who works with carcinogens in a regulated or designated area or support personnel who have had a high frequency of entry into a regulated or designated area is classed as being carcinogen authorized. A high frequency of entry is one that meets the frequency criteria outlined for beryllium workers above.

- ***Lead Worker***. Any employee whose assignment requires him or her to work with lead in an area where airborne lead levels are known to have been or can be reasonably expected to be greater than or equal to concentrations of 30 micrograms per cubic meter of air (30 $\mu g/m^3$) averaged over an eight-hour period.

- ***Radiation Worker***. Any occupational worker whose job assignment requires work on, with, or near radiation-producing devices or radioactive materials, and/or who has the potential of being routinely exposed above an Effective Dose Equivalent of 0.1 rem (0.001 sievert) per year is classed as a radiation worker. This Effective Dose Equivalent is the sum of the Annual Effective Dose Equivalent (AEDE) from external irradiation and the Committed Effective Dose Equivalent (CEDE) from internal irradiation. Any occupational worker who spends 20 percent or more of the work time inside a posted radiological area, or who works directly with radioactive material or radiation-generating devices will be considered a radiation worker. Any occupational worker whose sum of AEDE from external irradiation and CEDE from internal irradiation exceeds 100 mrem will be classified as a radiation worker unless investigation of the recorded exposure indicates otherwise.

- ***Respirator Wearer***. Any employee who is approved to wear a respirator is defined as a respirator wearer. Respirator wearers are included in this listing because work with any of the substances listed here also requires that the worker be able to wear a respirator.

- ***Toxic Hazardous Substance Worker***. An employee who meets the criteria for exposure to chemicals listed in the Y10-036 Appendix (e.g., asbestos, lead, mercury, and 23 additional items) is a toxic hazardous substance worker.

Assignment to the Programs

Employees who are newly assigned to a plant organization, or a new job in an organization, are evaluated by their supervisors for meeting the qualifications for placement in the Medical Surveillance Programs. The supervisors notify the Medical Director of names, badge numbers, and designations of the hazardous substance(s) with which the qualified workers work. These employees are added to the database of Y-12 employees requiring routine medical surveillance.

To help assure the medical surveillance database remains current, the Medical Director distributes computer reports with all employee names, ordered by badge number, and the required medical surveillances, substance(s), job, etc., that mandate the requirement. These lists are broken down by department and are sent to the organization managers every six months (January and July). The organization managers and supervisors review these reports, make any needed changes, and return them to the Medical Director for updating the entire roster.

<u>Physical Exams</u>

The Medical Director uses the information in the updated medical surveillance database to assist him in scheduling physical exams necessary to meet the surveillance schedule he has prescribed. Most of the workers listed above require annual physical examination. The physical exams for all individuals on medical surveillance are the same except that asbestos and beryllium workers require a chest x-ray, more frequent pulmonary function tests, and special questionnaires not required by workers with other potential exposures. Employees are scheduled for physical exams during their birth month. The HSO remains current with their schedule contracting for outside services when necessary.

Records

Upon completion of the medical surveillance procedure(s), the results and date of completion are entered in the computerized TMS. The information in this system can be accessed on computer terminals throughout the plant. This system provides convenient access to information necessary for a supervisor to ascertain whether employees selected for work with potentially hazardous materials have the required current medical surveillance.

The information entered into the TMS database is maintained on a continuing basis. This makes it possible to determine for the seven years these programs have been in place what potential hazards an employee has worked with, and for what period of time. This TMS database will identify which employees have specific exposure potential. Such information will be particularly helpful to epidemiologists concerned with exposures to substances for which there is no environmental or biological sampling program or large scale personal monitoring program, since such exposures are usually quantified only by expensive personal air samples which are few in number.

EFFECTIVENESS OF PROGRAMS

Evaluation of the Programs

The Medical Surveillance Programs are helpful in assuring that employees with exposure potentials do have the required medical surveillance. The degree to which these programs serve to identify exposure potential is dependent on how consistently and accurately supervisors identify employees that have exposure potential. The Y10-036 Procedure very likely increases the accuracy of the medical surveillance database, since the procedure defines very specifically which employees have the exposure potential requiring medical surveillance. A shortcoming of medical surveillance, as an indication of exposure, is that it does not quantify the exposure. Exposures to radiation and radioactive material are estimated by personnel dosimetry programs described elsewhere in these volumes. There are also biological personnel monitoring programs for lead workers (blood lead) and mercury workers (urine mercury). Assignment to these programs indicates the employees have exposure potential, and program results can be used to quantify the amount of exposure. For exposures to other chemically toxic materials, the only quantitation available is the personal air sample. Because of the expense and time involved with collection and analysis of such personal air samples, they cover only a small fraction of the workers and only a small fraction of the time worked with the potentially hazardous materials. To illustrate this fact, Table 1 shows how many employees are assigned to the medical surveillance programs compared to the number of eight-hour Time Weighted Average air results available. The number of biological personnel monitoring samples for the two programs that include this methodology is also shown for comparison.

Table 1. Comparison of Number of Persons Requiring Medical Surveillance to Number with Personnel Monitoring Results

	1996 Results Prior to or on June 6		
Toxicant	**No. Of Personal Air Samples**	**No. Of Personal Biological Samples**	**No. On Medical Surveillance**
Lead	2	72[1]	127
Mercury	4	87[2]	28
Asbestos	22	0.00	252
Man-Made Mineral Fibers[3]	11	0.00	0[3]
Carcinogens (Cr + Ni)	5	0.00	88
Beryllium	31	0.00	156

[1]Sampled once per year.
[2]Sampled once per month.
[3]Included with the asbestos workers.

It can be seen from Table 1 that air sampling time is only a small fraction of the total employee hours of potential exposure and that these air samples are the only personal sampling results available for the last four materials listed. Any estimate of exposure to employees with personal air samples would likely be poor.

According to the HSO policy, employees who do not appear as originally scheduled for their medical examinations are scheduled for a second time. Employees failing to appear for the second appointment are placed on the restriction list so that supervision realizes the required medical surveillance is not current. Likewise, persons who fail to pass a part of their physical examination are placed on this restriction list.

Observations

2. Historical information on assignments to the medical surveillance programs can be used to help delineate which employees may have been exposed to workplace hazards.

3. Such information may be the best information on exposure potential for many of the employees that work with hazardous materials for which there is no biological personnel monitoring program.

4. Personal air sampling monitoring covers only a small fraction of the total time worked by the employees wearing the samplers.

Recommendations

The body of information on employees potentially exposed to hazardous materials which is often used to estimate exposure should be improved. This improvement could be accomplished by installing a system that determines electronically what period of time personnel work in various areas. Such a system is currently under development as the third objective of this Center for Disease Control Project. This system coupled with a continuously operating area air sampling system could supply quantitative exposure information.

RETROSPECTIVE DOSE AND EXPOSURE REPORTING PROGRAMS

OVERVIEW

The Y-12 Plant in Oak Ridge, Tennessee, is presently operated for the Department of Energy (DOE) by Lockheed Martin Energy Systems, Inc., (LMES). Dose and exposure history information relevant to employment at the plant is available to employees, former employees, and heirs of former employees. This information is furnished by the Radiological Control (RADCON) Department and Industrial Hygiene Department (IHD) upon request as required by DOE regulations.

PROGRAMS

Dose or exposure histories will be furnished to individuals as indicated in Table 1 below:

Table 1. Dose and Exposure History Reporting

Type of History	Requested By	Requested To	Due	Information Forwarded
Dose (Termination Report)	Employee	LMES	90 days after termination	Dose or exposure history summary
Dose	Employee Former employee Heir of former employee	LMES LMES LMES	15 days after request 15 days after request 15 days after request	Dose or exposure history summary
Dose or exposure [Privacy Act and Freedom of Information Act FOIA)]	Employee Former employee Heir of former employee Legal Council	DOE DOE DOE DOE	10 days after request 10 days after request 10 days after request 10 days after request	Dose or exposure history summary[1]

[1] For Privacy Act and FOIA requests, plant employment and medical history is furnished. In addition, other information may be furnished from RADCON or the IHD files such as detailed monitoring data and memos and reports or publications that relate to the requested dose or exposure.

SOURCES OF INFORMATION

Information for responding to dose history requests comes from a number of sources as shown in Table 2.

Table 2. Sources of Information for Exposure Histories

	Sources	
Type of Request	**RADCON**	**Industrial Hygiene**
Exposure history	[1]OHIS - RADCON K-25 Central History Tapes Microfiche records RADCON personal folders Computer indices of archived information Hard copy data archives	The IHD does not receive such requests.
FOIA and Privacy Act Exposure history	All of the above sources Work history Pertinent medical records Memos, reports, or publications in plant files that contain name or other identifiers of the subject	OHIS - IHD Personal Folders Building Folders Hard copy data archives Electronic data archived

[1] Occupational Health Information System - a computerized records archive where both the RADCON and IH Departments have stored personal exposure or dose records since 1986 and 1989.

Additional details regarding the exposure and dose information available in each of the above records source are provided below.

RADCON Records Sources

Occupational Health Information System (OHIS)

The RADCON OHIS is a computerized records system where all dose information from both internal and external radiation exposures is stored beginning with reporting year 1989. The OHIS also includes the Bioassay Data Management System (BDMS) which contains detailed internal monitoring data generated from bioassays. The details of the external monitoring programs are similarly maintained in the Centralized External Dosimetry System. All of these systems are maintained by the Information Technology Services Division (ITSD) located at the K-25 Plant. Data from these systems are available online via local computer terminals in the Y-12 RADCON Department offices. Upon request, summarized historical data are also available for viewing and printing at these terminals.

If a hard copy of the detailed information is needed, it can be requested from the ITSD and mailed to the RADCON Department.

The BDMS has been maintained since 1994 and holds detailed data from the uranium urinalysis and *in vivo* monitoring programs. The urinalysis data are used as described in the *Internal Radiation Monitoring Programs - In Vitro* report in this volume to determine Annual Effective Dose Equivalents (AEDE) for the 1989 to 1993 period and Committed Effective Dose Equivalents (CEDE) for the period since 1993. These doses differ in that the CEDE includes the dose received in the year of intake plus any dose received in subsequent years from that intake while the AEDE only includes the dose for the year of intake. This change in methods for calculation of dose resulted from changes in DOE regulations. Although the AEDE dose is still being calculated, it is the preferred dose for epidemiologic studies; however, the CEDE is the required reportable dose. If *in vivo* data or fecal data are available, they will be factored into this CEDE determination. However, there have been no *in vivo* results exceeding the Minimum Detectable Amount (MDA) since the present system was installed in 1993. As explained in the *Internal Radiation Monitoring Programs - In Vitro* report, only those persons judged to have exposure potential are assigned to participate in these programs. (No dose is reported for persons not participating.)

Although the internal dose from uranium is to the lung, as determined at Y-12, its expression as a CEDE (which is a whole body dose) is equivalent under the assumptions made, to the determined lung dose. Under these assumptions, a calculated lung dose is multiplied by 0.12 to convert it to a whole body equivalent dose. An example of a CEDE report for the period since 1989 is shown in Table 3.

External dose, estimated from Thermoluminescent Dosimeters (TLD) as the deep dose for the year, as explained in the *External Radiation Monitoring Programs* report, is annually reported to each individual and entered into the OHIS as part of the individual's dose history. The deep dose is added to the CEDE and the sum is defined as the Total Effective Dose Equivalent (TEDE) (see Table 4), which is included in dose summary reports. Doses to the lung and other organs are also presently calculated and are reported in responses to all requests as shown in Table 3.

Table 3. Excerpt from an Internal Dose History Post 1989

Year	Radionuclide	Quantity (µCi)	Organ/Tissue	CEDE (rem)	Organ External Dose Equivalent	TEDE (rem)
1989	Uranium	9.18E-04	Bone Surfaces	0.013	0.102	0.115
			Breast	0.000	0.102	0.102
			Gonads	0.000	0.102	0.105
			Lungs	0.053	0.102	0.155
			Red Marrow	0.001	0.102	0.103
			Thyroid	0.000	0.102	0.102
			Remainder	0.000	0.102	0.103
1990	Uranium	1.32E-03	Bone Surfaces	0.018	0.143	0.161
			Breast	0.000	0.143	0.143
			Gonads	0.000	0.143	0.134
			Lungs	0.076	0.143	0.219
			Red Marrow	0.001	0.143	0.144
			Thyroid	0.000	0.143	0.143
			Remainder	0.002	0.143	0.145

Table 4. External and Internal Dose History since 1989

	External Dose Equivalent (rem)					
Year	Lens of Eye	Extremities	Shallow [Skin]	Deep [Whole Body]	CEDE[a] (rem)	TEDE[b] (rem)
1989	[c]	[c]	0.153	0.102	0.007	0.109
1990	[c]	[c]	0.149	0.143	0.010	0.153
1991	[c]	[c]	0.000	0.000	0.005	0.005
1992	[c]	[c]	0.162	0.000	0.001	0.001
1993	[c]	[c]	0.000	0.000	0.001	0.001
1994	[c]	[c]	0.000	0.000	0.000	0.000
1995	[c]	[c]	0.043	0.000	0.003	0.003
1996	[c]	[c]	[c]	[c]	[c]	[c]
		Cumulative Total Effective Dose Equivalent =				0.272

[a]Committed Effective Dose Equivalent.
[b]Total Effective Dose Equivalent.
[c]Monitoring not required.

ITSD Database

Prior to implementation of the OHIS, radiological dose data for Y-12 personnel were sent to the ITSD where the data are maintained on historical data tapes. The ITSD can generate reports in various formats as requested. When there is need to compile an exposure history for an individual employed at Y-12 before 1989, ITSD is asked to produce the report and forward it to the RADCON Department. RADCON personnel use the report in preparing a dose history summary which is forwarded to the requestor.

Tables 5 and 6 show excerpts from the internal and external dose summaries. As seen in Table 5, the results of urinalyses are not reported as dose, but as average percentages of the Radiation Protection Standard (RPS). The detailed monitoring results were originally reported exactly as determined, (that is, with no truncation at the MDA level). Consequently, some results are recorded as negative values due to great variability of the analyses and the fact that the appropriate background count subtracted from the sample results was greater than the counts of the samples. Although it is not possible to have a negative quantity of uranium in the urine, it is quite possible and even likely, to have a negative measurement of uranium in the urine, because of the factors just presented. These negative numbers are necessary to avoid a positive bias of averages for both individuals and groups.

Table 5. Excerpt from Internal Dose History Prior to 1989

Year	Analysis Type[a]	Nuclide	No. Of Analyses	Average % of RPS
1977	Lung	Enriched uranium	1	22.50
1977	Lung	Depleted uranium	1	Sample results less than detectable level, percentage not calculated.
1979	Lung	Enriched uranium	1	0.83
1980	Lung	Enriched uranium	2	3.33
1980	Urine	Uranium	8	14.15
1981	Lung	Enriched uranium	3	17.50
1981	Urine	Uranium	11	11.41
1982	Lung	Enriched uranium	4	31.56
1982	Urine	Uranium	7	12.27

[a]Analyses type listed as "lung" are *in vivo* measurement(s), and those listed as "urine" are for urine analysis for uranium.

Table 6. Excerpt from an External Dose History Prior to 1989

Year	Shallow [Skin] (rem)	Deep [Whole Body] (rem)

1972	0.000	0.000
1973	0.078	0.016
1987	0.110	0.110
1988	0.050	0.050
TOTAL	3.280	1.465

For a summarized dose history, any annual averages that are negative are reported as being less than the detectable level. However, Privacy Act and FOIA dose histories contain not only the summary dose histories, but also all individual positive or negative results as measured. If an annual exposure is calculated as more than 100 percent of the RPS limit, or if a dose history for the period prior to 1989 is requested, the calculation will be done using the present method for internal dose determination or an alternative method chosen by the dosimetrist as better suited for the case involved.

As previously noted, Table 5 shows average urine results before 1989 reported as a percent of the RPS. This percent of RPS is calculated by dividing the measured annual average excretion rate in disintegrations per minute per day's voiding (dpm/day) by 220 dpm/day, the rate that would be expected from an amount of uranium in the lung that would deliver a dose of 15 rem/year, and multiplying by 100 to convert to percent. Note that this is the dose to the lung, **not** the CEDE or AEDE reported for the 1989-to-date period. The limit for internal exposure prior to 1989 was expressed as dose to the lung rather than as CEDE. This lung dose limit was an annual dose, not the committed dose presently reported. For nonmonitored persons, no doses are reported.

As described for urinalysis results above, results from the *In Vivo* Monitoring Programs for the years prior to 1989 were also recorded exactly as reported by the counting device (that is, no truncation of less than zero results). Consequently, some results were negative due to the great variation in body count results which caused some counts in the uranium region to be less than background. The percent of RPS for *in vivo* measurement is derived by dividing the average annual *in vivo* lung count in µg of ^{235}U by the amount of ^{235}U in 93 percent enriched uranium that would deliver a dose of 15 rem/year to the lung (i.e., 240µg ^{235}U) and multiplying by 100. As can be observed, the results of these two programs are reported separately for each year when a person is monitored on both programs. Such results would not be additive, but considered as independent estimates of the amount of uranium in the lung.

Microfiche Records

Periodically, updated microfiche of employees' occupational radiation histories are prepared for the RADCON Department. These microfiche are used to quickly check the amount of information available for individuals and for checking other available information sources for accuracy.

Computer Indices of Pertinent Available Hard Copy Records

A computer index of locations of hard copy information on former employees has been prepared. The types of hard copy information indexed includes special folders on personnel who showed high levels of uranium on the urine or *in vivo* programs, reports of significant external exposures, or records of exposures when Y-12 workers were working for other employers. Using the hard copy records index, this information is retrieved, reviewed, and included in reports if it compliments or supplements the information available in the computer systems.

RADCON Personnel Dose or Exposure Folders

The RADCON Department maintains a hard copy file on each current Y-12 employee which contains the employee's annual dose report. This file also includes reports of any exposure incident in which the employee may have been exposed and copies of any dose or exposure histories that have been prepared previously. The contents of the personnel dose folders are checked for additional information that should be included or that will expedite the preparation of any required exposure histories.

For any Privacy Act or FOIA requests made through the DOE, photo copies of any hard copy information will be sent to the requestor. In these cases, a separate request is made from DOE to the Y-12 Health Services and Personnel Organizations to ascertain if they have filed information that should be reproduced and furnished to the requestor. These organizations respond to the request separately from the RADCON Department.

Compilation of the Dose or Exposure History

Once it is known that an exposure or dose history must be prepared, RADCON personnel will establish a folder to maintain the collected information and use a checklist (Figure 1) to help assure that no pertinent available source of information is overlooked.

Exposure History	___	Privacy Act	___	Termination	___
Date Received	___	Date Due	___	Date Sent	___

	Perform & Initial

Ensure that request has person's Social Security Number and signature.	
Enter information into Exposure History Request Logsheet.	
Make folder and attach checklist to folder.	
Look on OHIS to find badge number.	
Check segments 26-30 for post-1988 data and/or incidents.	
Check segment 45 for extremity monitoring data.	
Change to OHIS-HPIMS for Report HPX11 and printout all TLD assignments.	
Check BDMS for bioassay results (01/01/92-Present).	
For those with segment 28 editions, Change to OHIS-DR1 and print HPI11 (01/01/89-Present).	
Send request to K-25 C&TS for exposure history.	
After notification from K-25 C&TS, print radiation exposure history and place in folder.	
If employed at K-25, coordinate the receipt and/or distribution of additional exposure history information, including dates forwarded/received and enter dates on Logsheet.	
If employed at MK-F, PGDN, or ORNL, ensure that the appropriate letter stating the address of those companies is sent.	
Check Workplace Investigation Log (Kim Nugent) to determine if person has declared a pregnancy.	
Check Work History Microfiche for Social Security Number, hire/termination dates, facility employed & periods of employment.	
Check Y-12 Radiation Monitoring Microfiche.	
Check Y-12 Urinalysis and *In Vivo* Detail History Microfiche.	
Check Y-12 Internal Exposure Investigation Microfiche for any 1988-1993 incidents.	
Note any discrepancies, if needed, between microfiche, OHIS, & computer printout and add information to Excel spreadsheet.	
For Exposure Histories and Privacy Act Requests, contact Personnel Records to confirm employment dates, etc.	
Compile letter with attachments and print. Forward to External Dosimetry for review.	
External Dosimetry ensures external data is correct.	
Internal Dosimetry ensure internal data is correct.	
Transmit letter, if needed, to requester stating response is delayed but will be forwarded in the future.	
Give letter and attachments to Rhonda Board for signature.	
Mail originals to requestor and put copy of letter and attachments in folder, then file.	

05/03/96

Figure 1. Y-12 EXPOSURE HISTORY REQUEST CHECKLIST

Once all the available information is collected, a draft report is prepared, reviewed for accuracy, and edited as necessary. The final report prepared from the reviewed draft is approved by the Dosimetry Group Leaders then sent either to the requestor, or in the case of Privacy Act or FOIA requests, to DOE. DOE has taken the responsibility of assembling the information from the various organizations in Y-12 that may respond to such requests (RADCON, Industrial Hygiene, Personnel, and Health Services) and forwarding this information to the requester.

Special Consideration for Pregnant Females

DOE regulations require that monthly dose assessments for ionizing radiation be made for pregnant females for the period after the pregnancy is officially declared if the female continues to work in radiological areas. If a dose history is requested by a female who became pregnant after these regulations were imposed, these monthly dose assessments are included in her compiled work history.

Industrial Hygiene Records Sources

IH Occupational Health Information System (OHIS)

Since 1987, all personal sampling data on exposure to materials or stresses for which the IHD conducts monitoring programs have been maintained in the OHIS. These data include results of personal 8-hour Time-Weighted Average (TWA) or excursion (short-term) air concentration samples taken on individuals as well as results from biological monitoring programs such as those for blood lead analysis and mercury urinalysis. The IHD OHIS is maintained on a department computer server. The OHIS consists of a number of programs, collectively called the Comprehensive Tracking System (CTS) which is available for licensing to the commercial market. The IHD Information Management group has responsibility for entering appropriate data and maintaining the CTS.

Present Effort Toward Making Earlier IH Data More Readily Available

A large-scale effort is presently underway in the IHD to make the hard copy data generated by the department, during the years before the OHIS was in place, more readily retrievable. These data are being reviewed in detail and separated into folders according to sampling parameters such as sample type, sampling site, and so forth. Personal air or biological sampling results can be used to compile exposure histories relatable to an employee. Surface smear and periodic or continual air sampling results can possibly be related to employees through their work histories which identify departments and job titles that may be relatable to the buildings or areas where such air samples were taken. However, this association of employees with general air data is not currently being done by the Y-12 IH staff, and there are no plans to initiate such a procedure.

These hard copy files would serve as a source of information for exposure in some cases, if the relevant information could be located. However, the effort to locate specific hard copy records often can be extremely difficult and consequently quite costly. The ongoing computerization of these files will greatly facilitate locating such information.

A relatively large, but unspecified, quantity of data in electronic form is presently not readily retrievable due to lack of documentation and formatting problems. The Y-12 IH staff anticipate that these problems can be resolved and that the data can be made readily retrievable, but the amount of effort toward this end is limited by the lack of available funds.

The central focus of these efforts to make data more available, is on beryllium data which is estimated to be about 60 percent of all such data. However, other data will be processed as time and funding are available.

Personnel and Building Folders

Some data described in previous paragraphs have been separated into folders, some of which relate to individuals and others to Y-12 buildings. These data are joined with like information from other sources, and these personal folders can serve as a source of information for exposure histories.

Electronically Stored Information

There is much personnel monitoring and air sampling data on computer tapes. Although these tapes have been located, the details of what information is stored on them, and the format in which it is stored, are lacking. In addition, some fields in much of the air sampling data are coded, and the coding system for earlier years is not yet understood. These deficiencies are being addressed during the present computerization project, and it is expected that many of the deficiencies will be completely or partially resolved.

Compilation of Exposure History

According to IHD personnel, all external requests for exposure histories that come to the IHD are Privacy Act or FOIA requests that come through the DOE. Such requests are directed to the OHIS supervisor who then uses the sources listed above to compile any information that can be found. For these Privacy Act or FOIA requests, information on each monitoring action is furnished. No annual summary is furnished as is done for ionizing radiation dose histories. Table 7 shows an excerpt from a recently issued exposure history with all information identifying the employee excluded.

Table 7. An Excerpt from an Industrial Hygiene Exposure History - Privacy Act

Date	Assessment Type	Result Type	Result	Max Limit	Units	% Limit
Asbestos						
06/06/96	Air monitoring	8-hr TWA	<0.0052	0.1	f/cc	<5
06/06/96	Air monitoring	Excursion	<0.0623	1.0	f/cc	<6
02/19/96	Air monitoring	8-hr TWA	0.0124	0.1	f/cc	12
12/10/91	Air monitoring	8-hr TWA	<0.0131	0.2	f/cc	<7
12/10/91	Air monitoring	Excursion	<0.0131	1.0	f/cc	<1
11/21/91	Air monitoring	8-hr TWA	<0.0659	0.2	f/cc	<30
11/21/91	Air monitoring	Excursion	<0.0659	1.0	f/cc	<7
Ceramic Fiber						
10/24/94	Air monitoring	Excursion	0.3259	3.0	f/cc	11
08/18/93	Air monitoring	8-hr TWA	0.0048	1.0	f/cc	0
08/18/93	Air monitoring	Excursion	0.0775	3.0	f/cc	3
Noise						
06/12/91	Noise monitoring	8-hr TWA	74.8	85	dBA	88
02/13/91	Noise monitoring	8-hr TWA	58.2	85	dBA	68

Size and Cost of Programs

The level of effort by the RADCON Department, directed toward data compilation and retrospective dose or exposure assessment, is considerably greater and more extensive than for the IHD. Primarily this is because all Y-12 employees have been monitored for external radiation since 1961 with either film badges or TLD. In addition, a significant portion of the plant's population has been monitored since the early 1950s for internal exposure to uranium by *in vivo* lung counting or urinalysis. There was a period in the past history of the plant when a sizeable fraction of the plant population was monitored for mercury by urinalysis, and some employees are presently being monitored for mercury by urinalysis or for lead in blood. It is true that generally the number of employees monitored by personal samples is far less for chemical toxicants than for radioactive materials and radiation.

No cost estimate has been made for the Retrospective Dose and Exposure Reporting programs, because the costs attributable to the programs are almost impossible to differentiate from the total cost for data management within the RADCON or IH Departments. Although the overall cost and effort required for data management activities and computerization of records to make them more readily retrievable is large, we were not able to ascertain what fraction of the total RADCON or IH Department costs should be allocated to the retrospective exposure and dose programs.

Effectiveness of Programs

The RADCON Department's programs for reporting retrospective exposure or dose information appear to be well organized, efficient, and effective. The IHD has recognized the need for improving their ability to report retrospective data and have begun a large project of entering much of their older data (prior to 1986) into a computerized system which will facilitate their ability to report retrospective exposure data. However, even after this project is completed, the IHD historical database will remain much less extensive than that of the RADCON Department. The high cost in money and effort to do personal air sampling has prohibited the development of a large database for that kind of sampling information. More than half the data to be entered during this project is beryllium air sampling and surface smear results. The data are almost always associated with plant locations rather than employees. It is not presently known how well these results can be linked or related to individuals. Our experience with a number of similar projects in the past offer good evidence that this linking will be a long, tedious, and labor-intensive task. It is hoped that this data organizational project will significantly improve access to all the personal biological sampling results presently stored in either hard copy form or on electronic media much of which is difficult to locate and difficult to decipher once located.

OBSERVATIONS AND RECOMMENDATIONS

Observations

1. The RADCON Department is reporting retrospective dose data in several formats. Generally, this is due to reporting of dose as it was interpreted at the time of determination.

2. There is a paucity of information on personnel exposure before 1986 in the IHD database.

3. The IHD recognizes the deficiency in retrospective data availability and presently has a large scale project underway aimed at rectifying this situation.

4. It is not yet possible to definitively judge how fruitful this effort will be since much of the earlier IHD data was identified with locations rather than with employees.

Recommendations

1. The RADCON Department should consider whether it would be beneficial and feasible to reinterpret all internal monitoring data collected before 1989 using the current method of dose interpretation. It is believed that such an approach would be better understood and generally yield lower, more accurate doses.

2. The IHD should continue its efforts to expand its retrospective exposure database with special emphasis on data that can be readily related to employees.

PERSONNEL RESOURCES

Interviewers: C. M. West (W)
B. F. Rutherford (R)

Organizations Contacted: Radiological Control Department (RADCON)
Industrial Hygiene Department (IHD)
Analytical Services Organization (ASO)
Health Services Organization (HSO)

Person Contacted	Organization	Interviewer(s)	Subject
K.M. Bailey	RADCON	W, R	*In Vitro* Bioassay
R.S. Bogard	RADCON	W, R	RADCON Coordination
B.G. Bowers	RADCON	W, R	Field Surveys[1]
K.W. Branum	RADCON	W, R	Field Surveys[1]
A. Brynestad	RADCON	R	Procedures
R.E. Carroll	ASO	R	Analytical Operating Procedures
L.E. Cooke	IHD	W	IH in ASO facilities
T.J. Denton	RADCON	W, R	Field Surveys[1]
R.P. Ferguson	IHD	W	Other IH Programs
R.T. Ford	IHD	W	Miscellaneous IH questions
S.P. Ford	RADCON	W, R	RADCON ALARA[2] Programs
B.T. Gose	RADCON	W, R	*In Vivo* Operations
R.A. Hamby	RADCON	W, R	Radiological Control Instruments
J. Hendershot	IHD	W	Overall and IHD Coordination
E.R. Hinton, Jr.	ASO	W, R	Analytical Operations
S.M. Hollenbeck	IHD	W	Asbestos, MMMF[3]
J.L. Jenkins, Jr.	IHD	W	Beryllium
O.W. Jones	HSO	W, R	Medical Surveillance
W.O. Lawless	IHD	W	Mercury
L.L. Long	RADCON	R	Forms
T.W. Long	RADCON	W, R	*In Vivo*

PERSONNEL RESOURCES

Person Contacted	Organization	Interviewer(s)	Subject
F.J. Ludwig	RADCON	W, R	Field Surveys[1]
R.J. McElhaney	ASO	W, R	Analytical Procedures
V.W. Phillips	IHD	W	Lead
W.E. Porter	IHD	W	Beryllium, general
P.D. Pruitt	RADCON	R	Instruments
M.M. Reichert	ASO	W, R	Analytical Procedures
D.P. Rowan	RADCON	W, R	Miscellaneous RADCON questions
L.J. Schwanke	RADCON	W, R	External Dosimetry
P.M. Shelton	HSO	W, R	Medical Surveillance
J.L. Sherrill	IHD	W	Record System
W.A. Slishi	IHD	W	Carcinogens
J.L. Smith	RADCON	W, R	Dose History Formats
L.M. Snapp	RADCON	W, R	Internal Dosimetry
M.L. Souleyrette	RADCON	W	External Dosimetry
C.A. Steelman	RADCON	R	Instruments
J.M. Thomas	RADCON	R	Continuous Air Monitoring

[1] Field Surveys include air and surface contamination
[2] As Low As Reasonably Achievable
[3] Man-Made Mineral Fibers

REFERENCES

REGULATIONS, STANDARDS, PROCEDURES, AND DOCUMENTS
(Listed by issuer with number, date, and title)

FEDERAL

Number	Date	Title
10 CFR 835	12-14-93	Occupational Radiation Protection
DOE 5480.11	12-21-88	Radiation Protection for Occupational Workers
Method 6009	08-15-89	NIOSH Manual of Analytical Methods (Mercury in Air)
Method 7400	08-15-94	NIOSH Manual of Analytical Methods (Asbestos fiber sample collection, preparation, counting and reporting)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

Number	Date	Title
N13.6-1966 (R1922)	03-14-66	Practice for Occupational Radiation Exposure Records Systems

LOCKHEED MARTIN ENERGY SYSTEMS, INC.

Energy Systems Procedures

Number	Date	Title
Centralized External Dosimetry System (CEDS)	09-30-94	Technical Basis for the Centralized External Dosimetry System
CEDS 2-1-10	09-30-94	TLD Reader QC and Calibration
CEDS 2-2-20	06-30-94	Dosimeter Contamination Surveys
CEDS 3-1-500	09-30-94	Personnel Nuclear Accident Dosimetry

CEDS 3-1-505	09-30-95	Fixed Nuclear Accident Dosimetry
Energy Systems Standard ESS-IH-211	03-31-93	Worker Protection From Manmade Mineral Fibers

Radiological Control (RADCON) Procedures
Y-12 Plant

Number	Date	Title
Y70-100	09-11-95	Y-12 Plant Radiological Control Program
Y70-101	08-23-95	Transfer and Management of Materials for Radiological Control
Y70-105	08-08-95	Exposure Limits and Administrative Control Levels
Y70-106	08-31-94	Temporary Dosimeters for Permanently Badged Individuals
Y70-112	06-15-90	Previous Radiation Exposure Records for New Energy Systems Employees
Y70-117	02-27-95	Posting and Entry Controls
70-118	09-25-90	Request for Radiation Exposure Records and Histories
70-119	10-30-90	Whole Body, Neutron, and Extremity Radiation Monitoring
Y70-122	02-27-95	Radiological Work Permit (RWP)
Y70-124	02-27-95	Selection and Use of Protective Clothing for Radiological Protection
Y70-130	12-15-93	Uranium Bioassay Program
Y70-133	08-31-94	Dosimetry Services for Visitors to the Y-12 Plant

70-134	05-11-95	Y-12 Plant ALARA Program for Radiological Protection

Department

Number	Date	Title
Y50-66-HP-009	02-25-94	Area Monitoring Programs
Y50-66-HP-124	03-31-94	Personnel Contamination Survey Program
Y50-66-HP-133	01-31-92	Health Physics Smear Program
Y50-66-HP-134	11-30-91	Low and High Volume Air Sampling Program
Y50-66-HP-135	02-03-92	Retrospective Uranium Air Sampling Program
Y50-66-RC-142	04-10-96	Performance Testing of Radiological Control Instruments
Y50-66-RC-151	10-25-95	Operation of the Eberline Model Alpha-65 Continuous Air Monitor
Y50-66-RC-302	06-15-95	Calibration of an Eberline Model PCM-IB Personnel Contamination Monitor
Y50-66-HP-303	02-08-95	Calibration of an Eberline PCM-2 Personnel Contamination Monitor
Y50-66-HP-309	07-13-95	Calibration of F&J Specialty Products Model HV-1 High Volume Air Samples
Y50-66-HP-315	04-11-95	Calibration of a Ludlum Model 177-45 Alarm Ratemeter with a Ludlum Model 43-65 Alpha Scintillator Probe
Y50-66-HP-316	05-02-95	Calibration of a Ludlum Model 177-45 Alarm Ratemeter with a Ludlum Model 44-9 Alpha-Beta-Gamma Detector

Y50-66-RC-326	04-09-96	Calibration of an Eberline Model RM-14.5 Radiation Monitor with an Eberline Model HP-100-11 Gas Flow Proportional Detector
Y50-66-HP-404	02-15-95	Performing Internal Dose Assessments

Industrial Hygiene (IH) Procedures
Y-12 Plant

Number	Date	Title
Y70-036	04-15-93	Identification of Employees Requiring Medical Surveillance
Y70-049	05-03-96	Carcinogen Control Procedure (RW.01)
Y70-200	07-14-92	Industrial Hygiene
Y70-201	02-03-92	Plant Beryllium Protection Program
Y70-204	05-10-94	Asbestos Procedure for the Y-12 Plant
Y70-214	05-20-94	Asbestos Program Surveillance and Conformance
Y70-218	02-02-95	Y-12 Mercury Protection Program
Y70-219	07-15-94	Y-12 Plant Lead Worker Protection Program
Y70-220	03-30-94	Occupational Exposure to Hazardous Chemicals in Laboratories

Department

Number	Date	Title
Y50-66-IH-011	09-24-92	Personal and Area Monitoring for Chemical Contaminants
Y50-66-IH-013	04-30-93	Operational and Calibration of Dupont Model 2500 Air Sampler
Y-50-66-IH-057	08-14-91	Beryllium Smear Program
Y50-66-IH-058	08-15-91	Beryllium Airborne Monitoring Program
Y50-66-IH-069	02-03-92	Y-12 Industrial Hygiene Routine Sampling Program

Others (Health and Safety Procedures)
Y-12 Plant

Number	Date	Title
Y70-026	04-30-93	Occupational Injury and Illness Record Keeping
Y70-036	04-15-93	Identification of Employees Requiring Medical Surveillance
Y70-043	01-31-96	Job Hazard Analysis
Y70-050	07-15-94	Y-12 Respiratory Protection Program
Y70-065	12-15-92	Reproductive Hazards
Y70-220		Laboratory Chemicals
Y70-375	08-09-93	Construction Contractor--Safety and Health
Y70-379	12-30-92	Construction Contractor—Site Characterization and Worker Requirements
Y70-525	10-30-91	Operations Safety Work Permit

Y70-526	07-14-95	Health and Safety Readiness Review (H&SRR)
Y70-750	02-23-95	Confined Space Entry
Y70-800	09-28-95	Safety Analysis and Review System

Analytical Services Organization (ASO) Procedures

Number	Date	Title
Y/P65-0017	11-02-94	Determination of Metals on Filter Media by Inductively Coupled Plasma–Optical Emission Spectrometry (ICP-OES)
Y/P65-0019	10-31-94	Determination of Beryllium on Filter Media by Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES)
Y/P65-4010	12-19-95	Determination of Free Crystalline Silica in Air by Fourier Transform Infrared Spectroscopy
Y/P65-7027	07-12-94	Activity Counting for Air and Smear Samples Using the Sharp and LB-1000 Counters
Y/P65-7028	09-20-93	Determination of Uranium on Air Monitor Filter Papers Using the Liquid Scintillation Counters
Y/P65-7173	09-02-94	Preparation of Urine Samples For Isotopic Uranium Determination - Alpha Activity Counting Method
Y/P65-7174	06-16-95	Sample Receipt and Data Management For Bioassay Samples
Y/P65-7203	In Process	Isotopic Activity Determination in Bioassay Samples - Alpha Activity Counting Method

Y/P65-7626	04-30-93	Determination of Mercury in Urine and Blood by the Cold Vapor Atomic Absorption Technique (NIOSH P & CAM 165 & 167)
Y/P65-8537	01-18-96	Determination of Airborne Fibers by Phase Contrast Microscopy
Y/P65-9509	10-15-96	ASO Quality Control Procedure

RADCON Manuals

Number	Date	Title
Y/DQ-29	08-02-92	Technical Basis for Workplace Air Monitoring of Airborne Radioactive Material at the Y-12 Plant
None	01-12-96	Y-12 RADCON Organization
Y/DQ-34	01-18-96	Verification and Validation of the Y-12 Lung Counting System
Y/DQ-37	March 1993	Technical Basis for Workplace Surveys of Removable Radioactive Surface Contamination at the Y-12 Plant
Y/DQ-39	03-03-92	A Model For Uranium Lung Clearance at the Y-12 Plant
Y/DQ-40	10-27-95	Technical Basis Document for the Internal Dosimetry Program at the Y-12 Plant
Y/DQ-53	Oct. 1994	Y-12 Plant Fixed Nuclear Accident Dosimeter Program
Y/DQ-61	Sept. 1995	Y-12 Radiological Control Manual
Y/DQ-63	Aug. 1995	Selection and Justification of Y-12 Plant Continuous Air Monitor (CAM) Alarm Settings

Y/DQ-64	10-24-95	Guide to Radiological Investigations
Y/DQ-68	12-27-92	Y-12 In Vivo Lung Counter Training Guide
Y/DQ-70	01-12-96	Guide to the Administration of the Y-12 In Vitro Bioassay Program

IH Manuals

Number	Date	Title
No number	12-05-95	Lockheed Martin Y-12 Industrial Hygiene Department IH Laboratory Information Manual (Revision 4)
No number	01-29-96	Y-12 IH Area/Personal Air Sampling
No number	01-29-96	Y-12 IH Asbestos Clearance Sampling
No number	01-29-96	Y-12 IH Smear/Wipe Sampling for Metals
No number	01-29-96	Y-12 IH Beryllium Continuous Monitoring